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The Farmer's Digest

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The Farmer's Digest

Volume 7 January, 1944 Number 8

Calf Nutrition—The Problem

Condensed from Guernsey Breeders' Journal

Paul H. Phillips

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A CALF is a calf to the average citizen but to the scientist the calf is a three-phase enigma during its early existence. For the first ten days of life it behaves nutritionally like a single-stomach animal and not like the ruminant it is. During the second ten days of life there is the beginning of the shift to include the rumen in the digestive design of the calf. This transition continues and is completed or nearly so during the third ten-day period when the calf becomes a true ruminant. The transition from one phase to another is not sharp or distinct but it takes place, and is stressed here to emphasize the changing nature of the feeding problem at hand.

The nutritional requirements of the calf vary with each of these stages of development. During the first ten days the calf needs much vitamin A, appreciable quantities of a special protein, ascorbic acid and niacin (nicotinic acid). During the second stage the need for the vitamin A and protein is reduced to that found in milk, while the requirement for ascorbic acid diminishes because it is during this interval that the ability to synthesize ascorbic acid appears to develop. Niacin is still required. It is during the interval between the tenth day and the 30th day that the paunch or rumen develops and becomes a functional unit in the digestive physiology of the young calf. By this time the requirements for vitamin A have leveled off to about 1,000 micrograms daily, ascorbic acid is made in the calf's own factory and the paunch through its bacterial inhabitants is able to turn out all of the vitamin B complex needed. Special requirements for these nutritional substances will be discussed more fully later.

Until recently little attention has been given to the dietary fac-

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tors needed by the newborn calf. It has been shown that dietary factors in the early nutrition of the calf are far more important in the successful raising of the calves than the management changes which have been heavily emphasized in the past and which have in a large measure depended upon the skill and watchfulness of the caretaker. Adequate nutrition of the calf and particularly the very young calf will clarify many of the now troublesome problems of raising calves.

The practical nutrition of most of our farm animals begins after weaning. Not so with the calf. We take charge of the calf the minute it appears and we've been trying dietary substitutes on the little fellow for years. It is the author's opinion that there is no completely satisfactory substitute for milk for the nutrition of the newborn calf. The calf arrives deficient in several respects. First of all, it needs a special protein material with which to build an immunity against infection. This protein is composed of globulins which are found in abundant amounts in colostrum, or first milk. Secondly, the calf arrives with little or no reserve supply of vitamin A. Vitamin A therefore must be supplied quickly and in liberal amounts in the early feeding of the calf. Colostrum milk again furnishes the initial starting material for it is ten times richer in vitamin A potency than ordinary milk, which normally is an excellent source of vitamin A or its precursors. Thirdly, the calf arrives with a paunch which has not begun to function. This is the organ in which the vitamin B complex required by the cattle is produced. There are still other deficiencies but it is apparent from the above that the newborn calf has definite nutritional handicaps to overcome in order to bring himself into balance with his surroundings. He must be fed for the first ten to 20 days as though he were a single stomach animal. Then another ten days is required before his vitamin B complex factory, the paunch, gets into production. The calf in the early stages of its life must be fed then according to its development. That is one of the reasons why milk which is one of the best foods is so necessary in the early nutrition of the calf.

However, milk is relatively low in niacin (Nicotinic acid), one of the B vitamins. At birth the calf must have a supply of this vitamin to carry it through until its B vitamin complex factory begins to work which, as mentioned before, requires three to four weeks. Frequently the calf does not have a reserve supply of niacin sufficient to meet its dietary requirements up to this stage. In such cases niacin must be fed. Niacin

can be purchased readily in crystalline form like salt and it is not expensive in view of the amounts required.

The newborn calf comes into the world exceedingly well fortified with vitamin C, or ascorbic acid. The ascorbic acid reserves, however, are quickly used and the calf depends upon its food for its early supply of the vitamin. Under ordinary circumstances this vitamin is synthesized in sufficient amounts by the older bovine, whereas in the calf the ability to make ascorbic acid is limited or lacking until it is 15 days of age or more.

The function of ascorbic acid in the calf seems to be one of combating infection. Giving ascorbic acid to young calves is specific or nearly so for combating navel infections. In other infections, particularly those accompanied by fever, the ascorbic acid of the blood of the calf drops sharply and the administration of the vitamin brings about a favorable and oftentimes dramatic response. Recent experiments have demonstrated that extra amounts of ascorbic acid given during the early days of the calf's life will in part at least replace the globulins of colostrum heretofore considered an early dietary essential for the building of an immunity against infections. Holstein calves have been successfully raised from birth on vitamin fortified skimmed milk without access to any colostrum when liberal amounts of ascorbic acid were given.

The beginning of sound nutritional practice in calf feeding then is based upon the recognition that the calf is a rapidly changing individual during the early weeks of life, and that his dietary requirements differ markedly during the first ten days from that of four weeks of age. Stress should be placed upon the liberal use of colostrum milk in early calf feeding because of the liberal amounts of the globulin proteins and vitamin A that it contains. Niacin and ascorbic acid are needed in supplemental amounts to those found in normal milk. Good nutritional practice would also include milk in liberal amounts following the colostrum milk feeding period for at least three to four weeks before heavy replacement of the milk of the diet is made. This does not mean that grain and good quality hay should not be placed before the calf at all times, or that teaching him to eat these feeds should be delayed because it is the roughage portion of the ration which furnishes most of the vitamins needed for the health of the growing calf. The hay if it is of good quality will furnish carotene, the substance out of which cattle make their vitamin A. Corn silage made in the early dent stage, or

good grass, or legume silage can be fed to calves with considerable advantage. Silage increases the amount of carotene as well as certain other vitamins of the ration. Calves would be a lot healthier and more vigorous if they were fed more good quality roughages. In the Guernsey the carotene problem is more acute than in the other breeds and hence good quality green hay and silage in the ration of the calf is all the more important.

The use of milk substitutes will be resorted to in certain areas. When this is the best economic practice, such substitutes should be amply fortified with vitamin A and niacin. Young calves cannot always make vitamin A from carotene as older cattle do, therefore vitamin A is the vitamin needed in the early feeding of the calf. It has been the custom among dairy cattle feeders and nutritionists to speak of vitamin A synonymously with carotene. This may hold for the older cattle but it should be emphasized here that it is *vitamin A itself that is needed* in the ration of the newborn and young calf.

Rye May Be Worth $35 An Acre

Rye pasture may be worth as much as $35 an acre as an early spring pasture for cattle and, faced with shortages of hay and other feeds, operators can provide for increased production in 1944 by seeding small acreages to rye during August and early September.

Pasture demonstrations conducted at the University of Illinois College of Agriculture indicate the high value of rye in a pasture program, says C. S. Rhode, professor of dairy husbandry extension.

A combination of rye for late fall and early spring pasture and Sudan grass for summer produces more milk an acre than any other pasture crop grown on the University's farm. After the rye is pastured off, in the spring, it is turned under and seeded to Sudan grass.

Usually, one acre of rye for two to three cows is sufficient. Under normal conditions, rye seeded in August or early September at a rate of one and three-fourths to two bushels an acre will produce succulent fall pasture and an abundance of early spring feed. After two to four weeks of pasturing in the spring, the rye may be plowed and Sudan grass seeded.

—*Shorthorn World*

Factors That Help Boost Income

Condensed from Poultry Tribune

L. B. Darrah

Cornell University

PRICES in relation to costs cause variations in the income on any farm from year to year. In any one year, the incomes vary from farm to farm because of several different factors, most important of which are (1) work units, which is a measure of size of business, (2) eggs produced per layer, which is a measure of the rate of production, and (3) work units per man, which is a measure of labor efficiency.

There are many different ways of measuring the income or the financial success of a poultry farm business. In most cases, the most useful measure to use is called *Labor Income.*

The labor income is what the farmer receives for his year's work in addition to a house in which to live and farm products and privileges furnished by the farm toward the family living.

To calculate the labor income for a farm, the farm expenses and an interest charge of 5 percent on the capital invested in the farm business are subtracted from the total farm receipts. The remainder is the return to the farmer for his labor and management for the year, or labor income. The method of calculating labor income is shown in Table 1.

Table 1. Average Labor Income, 120 Poultry Farms. New York, 1940-41

Item	Average Per Farm
Total capital	$17,178
Farm receipts	8,993
Farm expenses	6,533
Farm income	$2,460
Interest on capital at 5 percent	859
Labor income	$1,601

(Data used to illustrate this discussion are adapted from a recent farm management survey of commercial poultry farms, which was conducted by the Department of Agricultural Economics, N. Y. State College of Agriculture, Cornell University, Ithaca, N. Y.)

Work Units and Labor Income

The best single measure of the size of a farm business is total work units. A work unit represents the average amount of productive work accomplished by one man in one day. It takes, on the average, one day of labor per

Reprinted by permission from the Poultry Tribune, Mt. Morris, Illinois, Nov., 1943

year to grow and harvest an acre of hay, and about 20 days of labor per year to care for 100 hens. Thus, an acre of hay is considered to be one work unit, and 100 hens, 20 work units. In like manner, work units are calculated for all the income producing work performed on a farm. The total work units for a farm are determined by adding all the work units represented by the different enterprises that make up the farm business.

On strictly specialized poultry farms, the average number of layers kept during the year would be a good measure of the size of a farm business. However, most poultry farms have other enterprises, hence total work units more completely measure the size of business.

The poultry farms included in the survey were divided into three near-equal groups according to the number of work units per farm. The farms with less than 400 work units had an average labor income of $659, while those with 400 to 650 work units had an average labor income of $1,515. The farms with more than 650 work units per farm had an average labor income of $2,587, which was about 4 times more per farm than those with less than 400 work units. An increase of 100 work units was accompanied by an increase of $225 in labor income.

Table 2. Work Units and Labor Income, 120 Poultry Farms, New York, 1940-41

Number of Work Units	No. of Farms	Work Units per Farm	Labor Income
Less than 400	38	254	$ 659
400-650	42	507	1,515
More than 650	40	1,009	2,587
Total or average	120	594	$1,601

The farms with large businesses pay best because, first of all, the more eggs sold at a favorable margin between production costs and prices received, the larger the income. (Of course, if the margin were unfavorable, the more units sold, the lower the income.) Secondly, the available labor is used more efficiently, since many of the chores do not increase in proportion to the increase in the number of work units. It takes as much time to walk a given distance to the feed room to get feed for 100 layers as it does for 200 layers, or even 500 layers. Thirdly, the investment in farm buildings and equipment does not usually increase as rapidly as the increase in size of business. Lastly, a large poultry business makes it possible to have enough eggs to market them often and thus obtain the benefit of the higher prices that are paid for fresh eggs.

Eggs per Layer and Labor Income

As the number of eggs produced per layer increased, the labor income per farm increased. On the farms where the number of eggs produced per layer was

less than 160, the labor income averaged $1,289, while on the farms where the rate of production was 160 to 179 eggs per layer, the labor income was $1,665. The farms with a rate of production of more than 179 eggs per layer had an average labor income of $1,905, which was $600 more per farm than for those with a low rate of egg production.

Rates of production are very important now because almost all of the items that enter into production costs are much higher than in previous years; consequently, more eggs are required to pay the hired man, the feed bill, the repair bill, and the many other bills which must be paid from the egg sales.

Table 3. Eggs Produced per Layer and Labor Income, 120 Poultry Farms, New York, 1940-41

Number of Eggs Produced per Layer	No. of Farms	Eggs Produced per Layer	Labor Income
Less than 160	44	145	$1,289
160-179	39	170	1,665
More than 179	37	194	1,905
Total or average	120	168	$1,601

Although egg production per layer is determined quite largely by breeding, poultrymen can do many things in addition to using care in selecting the chicks to help keep the birds at a high level of production. Some important practices to follow are (1) a constant culling program to remove unproductive birds, (2) good feeding practices, (3) good housing, and (4) good sanitation to keep the birds as free as possible from diseases, and internal and external parasites.

Work Units per Man and Labor Income

Labor represents an important item of expense on poultry farms, hence it is very important that it be used efficiently. In other words, each poultryman should attempt to keep his labor supply continually occupied at income-producing work.

Since work units was the best measure of size of business on these poultry farms, work units per man is a good measure of labor efficiency. As the work units *per man,* or labor efficiency, increased, the labor income increased. The farms with less than 200 work units per man had a labor income of $759, while those with more than 275 work units per man had a labor income of $2,082.

Table 4. Work Units per Man and Labor Income, 120 Poultry Farms, New York, 1940-41

No. of Work Units per Man	No. of Farms	Work Units per Man	Labor Income
Less than 200	32	145	$ 759
200-275	45	236	1,741
More than 275	43	340	2,082
Total or average	120	249	$1,601

For the highest degree of financial success in farming, it is not enough to be above average in only one or two factors. The

largest incomes generally are obtained on those farms where as many factors as possible are average or better than average.

When the factors, work units, eggs produced per layer, and work units per man, are considered, the farms below average in all three factors had an average labor income of *minus* $15. Farms with only one factor average or better had an average labor income of $1,263, while those with any two factors average or better had a labor income of $2,343. The farms with all three factors average or better had an average labor income of $2,552, which was nearly $2,600 more per farm than for those below average in the three important factors.

Soil Yields Miracle Drugs

Condensed from Capper's Farmer

SCIENTISTS are returning to the earth for new chemicals with which to fight hitherto unconquerable diseases. Recently they have sought the help of agricultural experiment stations and research laboratories in the development of a new family of drugs which may eliminate many of the diseases that now take a heavy annual toll of human life. Already chemicals that are hundreds of times more powerful than previously known compounds, and in many cases safer to use, have been discovered.

These new miracle drugs are taken from the soil. An ounce of good soil contains billions of living organisms, and an unknown number of these may, in time, be trained to work for the good of man.

As far back in time as there are records man has been afflicted by disease; and always he has sought means of combating it. Early methods employed were crude and inadequate. But it gradually became apparent that bodily cleanliness, the burial of excreta, the burial or burning of corpses and the isolation of the sick, all seemed to halt the spread of certain diseases.

A much better understanding of causes of disease developed in the latter half of the 19th century, when the existence of the world of microbes was discovered. Scientists realized that certain of these microbes, once they found entrance into the human body, caused diseases. Disinfection was adopted to prevent microbes from entering the body thru cuts,

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bruises, wounds and burns. Milk was pasteurized and water was purified, because it was recognized that microbes entered the body with food or drink.

Since many microbes continued to penetrate even the new defenses, science was forced to undertake a search for the means of fighting against microbes after they had entered into the bodies of men.

Paul Ehrlich, pioneer in this field, found that killing a microbe in a test tube was a simple matter, but that to kill a microbe in the human body without killing the patient as well was something else.

Specifically, Doctor Ehrlich was seeking a chemical substance which would kill the spirochete—a protozoan or animal type of microbe — that causes syphilis. After years of experimentation he produced salvarsan and it was successful.

Ehrlich's discovery created a new branch of science—chemotherapy, and the possibility of combating protozoan microbes with chemicals was finally recognized scientifically. Since Ehrlich's epoch-making work, chemotherapy has grown widely and dramatically.

Unfortunately no such progress had been made in the cure of diseases caused by bacteria — a group of microbe organisms quite distinct from the protozoan types studied by Ehrlich. The many ailments in this classification include pneumonia, diphtheria, typhoid, plague, cholera, dysentery, influenza and tuberculosis. For some of these—typhoid, for example—vaccination proved successful; but others defied all attempts at control. Scientists applied themselves to the problem but, as time passed and they remained unsuccessful, it was generally believed that no chemical would ever be found which would be destructive to these bacteria and at the same time harmless to the human body.

Then, less than a decade ago, and with startling suddenness, the sulfa drugs were discovered. Here were chemical substances that did act on disease-causing bacteria. Immediately laboratories all over the world began to study these new drugs, improve their chemical nature, and develop numerous derivatives. As quickly as the scientists worked the doctors put the new products to use—and with remarkable success. For a while sulfa drugs were regarded as virtual cure-alls. Certain bacteria, however, remained impervious to their effect. To some people the sulfa drugs were harmful. Nevertheless these new chemicals proved efficacious in the control of numerous diseases. Their discovery reawakened and revitalized the search for chemical substances capable of conquering bacterial parasites.

The intuitive reasoning of ancient peoples pointed to a possible solution. For thousands of years men had buried disease-ridden corpses and thereby rendered them harmless. Now this age-long practice was held up to new scrutiny: if there was something in the soil that killed parasitic bacteria, scientists wanted to know what it was. The extensive literature in the field of soil bacteriology was dug out of files and re-examined. And as the investigators delved deeper they became more and more convinced that the agricultural experiment stations, with their many years of experience in the study of the soil and its microbes, could do much to further this vital investigation.

The New Jersey Experiment Station at New Brunswick had by the late 1930's, a long tradition in soil research, and students came from many parts of the world to study under the guidance of Selman A. Waksman, the Station's microbiologist. It was natural that Doctor Waksman and his associates should be asked to turn their knowledge of soil bacteria to the aid of medical science.

The scientists soon discovered that it was the numerous bacteria normally existent in the soil which destroyed the dangerous parasitic bacteria infesting diseased corpses. Their job, therefore, was to isolate from the soil's mixed bacterial population those types that were effective in combating a specific parasitic bacterium.

If, for example, the object was to find a means of controlling a disease-producing bacterium called Bacterium "A," this is what they could do:

A quantity of fresh soil, containing countless bacterial types, is brought into the laboratory. In this artificial environment the "residents" are faced with the problem of obtaining food; ordinarily they live on a naturally-replenished supply of decaying animal and vegetable matter, but now their normal sources are cut off. They cannot eat each other; the mutual adjustment they have made over the long period of their communal living renders them harmless to one another even in the face of near-starvation. When they have grown sufficiently hungry, the scientist introduces into their midst a quantity of Bacterium "A."

He hopes the stranger will be consumed—he is searching for a Bacterium "A"-destroying force. And sometimes his hopes are realized. When that is the case a microscopic examination of the soil community shows that "A" has disappeared, that many of the native microbial residents have likewise vanished, but that others have thrived and multiplied. The scientist can then assume that the vanished natives

starved to death, and that the survivors are those bacteria which were able to find nutriment in "A" and therefore consumed it. The next step is to breed a quantity of the survivors on a strict diet of "A" until they have developed a voracious appetite for the parasite.

By what means are certain bacteria able to live on "A"? Investigation shows that they excrete a chemical substance capable of changing the parasitic bacterium into an edible material—something their now extinct neighbors were unable to do. A quantity of this excretion—called an antibiotic substance—is then collected, purified and concentrated.

The scientist now has in his test tubes a chemical which, like the sulfa drugs, is capable of destroying a parasitic bacteria—in this case, Bacterium "A." But the most important test is still to be made: can it be used safely in animal or human bodies? A long period of research ensues, during which healthy mice, rabbits and other laboratory specimens are injected with the new antibiotic substance. If the animals are not harmed by it, the antibiotic is then injected into live specimens already infected by Bacterium "A." If it passes this test—if it kills "A" and does not kill the animal—it may now be turned over to commercial drug companies for further testing and, if it seems to be feasible, for commercial production.

Such, in brief, was the procedure followed in the development of several new chemical substances, 2 of which already are proving themselves to be of startling value: gramicidin, isolated by Rene Dubos (a former student of Doctor Waksman's) while working at the Rockefeller Institute; and penicillin, a discovery made by Professor A. Fleming, of St. Mary's Hospital in London, England.

Gramicidin has proved itself to be powerful almost beyond comprehension. Ten thousand fatal doses of a pneumonia-producing bacterium injected into the body cavity of a mouse proved harmless in the presence of less than one-millionth of an ounce of gramicidin! Ulcerous wounds of years' standing have been healed in 3 weeks by the application of this drug and, in some cases, sinus sufferers have shown marked signs of improvement within 24 hours of a gramicidin treatment. There is, however, one drawback to the use of this new substance: it cannot be injected into the blood stream, for it destroys the red cells of the blood. For this reason its use is restricted to local wounds, or to injections into body cavities.

The use of penicillin is free from this difficulty. It is harmless

to the blood and by intravenus injections can be carried thruout the circulatory system to the site of the infection—a property that greatly increases its usefulness in the treatment of disease. It is already being used in the treatment of blood infections where sulfa drugs have been ineffective. It has proved of value, too, in the treatment of septic wounds, certain sulfonamide-resistant cases of pneumonia, hemolytic streptococcus, anaerobic pathogens, and various other types of streptococcal and staphylococcal infections.

At the New Jersey Experiment Station 4 new antibiotic substances have thus far been isolated. Named after the microbes that produce them, they are called actinomycin, clavacin, streptothricin and fumagacin. The first two are toxic and therefore cannot be used, in their present form, for the treatment of humans or animals; but the other two show great promise of practical application. They may, in time, take their place with the sulfa drugs and the 2 already-established antibiotic substances in the growing list of chemical agents that are used in combating bacterial diseases in man.

It is only natural that emphasis should be placed on the ability of these new antibiotic substances to fight human diseases, but it must not be forgotten that they are also being tested on, and finding application in, the treatment of animal ailments. Dairymen know what mastitis can do to a herd of cows. In 1940 mastitis was discovered in a prize herd at the Walker-Gordon farm at Plainsboro, New Jersey. Gramicidin was injected into the udder in the morning and milked out that night; the next day the procedure was repeated—and in two days 12 of the 16 cows were found to be free from infection.

The parasitic bacteria that cause many other diseases of animals are now being studied in the laboratories of the New Jersey Experiment Station, and already experiments there point to a wide future use of antibiotic substances against certain animal diseases that now cost the American farmer millions of dollars each year.

Breeding High Testing Holsteins

Condensed from The Southern Planter

THIRTEEN years ago Dean J. G. Lipman, of Rutgers University in New Jersey, received a telephone call from a man by the name of James N. Turner, requesting the dean to meet him at his Sussex County farm in the fertile dairy country of north Jersey. Dr. Lipman took with him the young, enthusiastic head of the college dairy department, Dr. J. W. Bartlett. Before dark that evening, Mr. Turner had donated to Rutgers University for research purposes, 1,200 acres of wonderful farming land equipped with nearly a quarter-of-a-million dollars worth of dairy barns, buildings and machinery.

Driving back to New Brunswick that night, Dr. Lipman remarked, "It's a wonderful gift, Jack, but I don't know what in the world we will ever do with it."

"Let me have it for dairy research," was Jack Bartlett's reply. "I'd like to breed high testing Holsteins; I believe it can be done."

"You're elected," the dean came back. And thus one of the most thrilling chapters in Holstein history was begun.

The New Jersey legislature granted a modest appropriation to acquire foundation animals and set up a small staff of research workers. Dr. Bartlett was given the "green light" at a time when the country was wallowing in the depths of the depression. The dairy industry was on the brink of bankruptcy; only rich yellow milk was moving. Milk wagons in Philadelphia carried pictures of Jersey cows; Golden Guernsey milk was taking the table trade. The trend was toward the high-testing breeds. Yet 80 per cent of the milk cows in New Jersey were Holsteins, and the national average test for the breed was only 3.4 per cent butterfat. So the eyes of New Jersey were upon Jack Bartlett as he set out with Allen Crissey, fieldman of the Holstein-Friesian Association of America, in quest of Holstein stock of high butterfat test.

After scouring the country, Bartlett and Crissey came back with 40 cows, two bulls and half interest in another bull, Ormsby Sensation 45th, that was later to become Bartlett's "leading man." Each cow selected had to test 3.6 per cent fat, or better; her production, corrected to 4 per cent, had to be above 15,000 pounds of milk; and her type had to be good. Such Holsteins were

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hard to find, but 7 were obtained from each of two different herds. The average cost, even then, was $350.

"In a small farm herd of 30 head, owned by Robert E. Eddy, at Poultney, Vermont," Dr. Bartlett said, "Crissey and I found a grand array of beautiful cows, some testing 4.3 per cent and winning consistently in the show ring. The best individuals had all been sired by the same bull. He had just been sold, to avoid mating him to his own daughters, to Bellevue Farms, Hyattsville, Maryland, for $1,500."

The bull, Ormsby Sensation 45th, by this time was gaining considerable prominence. He was the first prize bull at the New York State Fair in 1927; the best bull in the United States for average production of daughters in 1931. Naturally, Bellevue Farms wanted to hold on to such a sire. But Bartlett finally induced Bellevue to sell half interest in the bull to Rutgers for $2,000. For the rest of his life, Ormsby Sensation 45th was to live 6 months in Maryland and 6 in New Jersey.

"We began at once to concentrate this high testing blood by close inbreeding—mating daughters to sire, sons to dams and practicing brother and sister matings," Dr. Bartlett pointed out. "And immediately it became evident that a program of inbreeding with two of our bulls could not be pursued further. A lethal factor in these bulls caused the death of many calves, either at birth or shortly thereafter. The two bulls were abandoned in 1936, and the inbreeding of the Sensation family increased with renewed vigor, using artificial insemination to get a wider dissemination of the inbred blood."

It should be pointed out here that the six artificial breeding associations in New Jersey and the 13 herds in State-aided institutions, cooperating in a centralized breeding program have been of invaluable service to Dr. Bartlett as a proving ground for bulls. Together they have quickly proved good sires and saved them; detected sorry sires and sent them to the butcher. The Experiment Station has served as the source of all sires in the breeding associations and accurate records of their daughters have been saved and studied. The service of such a set up in other states cannot easily be over-emphasized. "Through our arrangement," Dr. Bartlett prophecies, "it will be only a very short time before all Holstein cows in New Jersey will be *sisters under the skin.*"

Just as quickly as the Experiment Station develops a bull that combines type with ability to transmit high test and good volume of production to his daughters, he is put into the artificial

breeding units so that his blood can quickly be infused into commercial herds. In this way the reproductive fluid from one service of an outstanding bull may be diluted with egg yolk and phosphate and held for a couple of weeks, or shipped half way across the country, and impregnate as many as 20 cows. The artificial breeding work, begun in New Jersey about 5 years ago, has enabled purebred breeders to acquire this blood and develop superior sires themselves for sale.

For instance, the Vineland Training School's herd, at Vineland, using 100 per cent Ormsby Sensation 45th breeding from the Experiment Station, rated second for production in the United States for herds of 30 to 50 cows last year, and third for all time.

To cite another case, we visited the Hillsboro Farm of Peter P. Van Nuys, at Belle Meade, whose 30-cow herd of Holsteins 10 years ago averaged 11,000 pounds of 3.2 per cent milk. Using a double grandson of Sensation 45th, NJES Sir Mutual Ormsby Jewel Alice, which came to New Jersey in dam, and a grandson, Bellevue Pontiac Ormsby, Mr. Van Nuys has developed a herd of 45 to 50 cows that now average better than 11,000 pounds of milk testing 4 per cent. These cows are big, beautiful and milky. In good flesh they will weigh 1,600 pounds apiece and look the perfect dairy type. We saw one old cow in this herd, nearing her 14th birthday, that has a lifetime production of 125,000 pounds milk and 5,000 pounds fat. Last year she made a record of 12,800 pounds milk, testing 4.1 per cent. Mr. Van Nuys is a plain, dirt farmer with 200 acres of land and a herd of high-testing, high-yielding Holsteins that are putting their owner on Easy Street.

The Alice bull, used originally on the Hillsboro herd, was the first bull tried in the artificial breeding work in New Jersey. He is still being used, and with phenomenal success, at the Experiment Station.

At Somerville, we stopped to see Charles V. N. Davis and his son, William, owners of Woodview Farm, who have used the inbred Sensation 45th blood in a 50-cow herd for 8 years. The average production last year was 11,600 pounds of milk testing 3.7½ per cent. Eight years ago the butterfat test was 3.4 per cent and the milk volume about the same. Two cows in the herd are testing 4.2 and 4.3 per cent. The Davis' farm 210 acres in grass and grain, and depend upon their cows for a living.

"A neighbor of mine bred a good cow to the first Sensation bull I had," Mr. Davis told us. "When the calf came, a heifer, my neighbor was selling her for veal. I was over there that night

in my truck and my boy wanted a 4-H Club calf. 'What do you want for the calf,' I asked. 'Seven dollars,' was his reply. So I said, 'Throw her in the truck.' That cow, now 11 years old, has given us 112,216 pounds of milk and 4,772.8 pounds of butterfat. Her best year was 728 pounds of fat."

A bull now in service at Woodview Farm is out of this grand old butterfat queen by the great Alice bull, proved by Mr. Van Nuys. At 5 years old, through artificial breeding, he has been mated to nearly 800 cows.

At the New Jersey Dairy Research Station, Sussex, Dr. Bartlett and his associates have 44 Holsteins at the pail. The average number of days in lactation is 209. The cows average 27.2 pounds of milk per day in September with a butterfat test of 3.91 per cent. Half of the herd is testing over 4 per cent, with 9 testing better than 4.3. These cows are getting commercial dairy herd care—a pound of grain to 3 pounds of milk produced, some silage and hay, and a little grazing. They are milked twice a day. All carry Sensation breeding.

We saw these cows milked twice, and examined them closely in the pen and in the pasture. The inbred cows are bigger, better and more beautiful than the line-bred stuff. Two inbred strains within the Sensation family are being constantly crossed back and forth to increase size, vigor and productivity. The bulls are massive, stretchy and dairylike. One big fellow, NJES Sensation Ormsby Bess Chief, an inbred son of old 45th weighs in good breeding condition, 2,200 pounds. He is 11 years old, has 22 daughters under test that average 614 pounds of fat. Some are testing 4 per cent; all average 3.73.

"We have now reached the point in our breeding work," Dr. Bartlett concludes, "that by rigid selection, saving only the best bulls from our 3.8 or 3.9 per cent high producing cows, and folding together the two inbred families of Ormsby Sensation 45th, we can fix these desirable factors so they will stay fixed."

The old bull died with a nail in his heart, at Hyattsville, Maryland, a few years ago, at the age of 11 years. The nail, eaten with feed, was sharpened by the digestive acids and eventually worked through the stomach wall, puncturing his great heart. He dropped dead. But skillful inbreeding during his lifetime concentrated his royal blood in a family of Holsteins that is building an everlasting monument of butterfat to his memory, according to a plan designed by the master builder, Jack Bartlett. As long as Holstein cattle are bred, the blood of Ormsby Sensation 45th will pulsate in their veins.

Cuts Milking Time in Half

Condensed from The Farmer

THERE is a new way to do the commonplace job of milking. By udder massage and by washing the udder with warm water immediately preceding milking, the time required to milk is reduced by one-half or more, the incidence of mastitis is reduced, and milk production continues high or higher than under old milking methods.

The utter simplicity of this new method divests it of any appearance of magic, yet its effects are magical. Henry Wildung, owner of a 39-cow Guernsey herd near Owatonna, Minnesota, will testify to that. So will Frank Astroth, whose splendid Jersey herd near St. Paul is milked by the new method, and out in California near Stockton, there is a 220-cow herd on the Clowes Dairy Farm that two men milk in three hours!

The new method is another practical application of information growing out of research work that has been carried on for several years by Dr. W. E. Peterson and his associates of the College of Agriculture, University of Minnesota. Dr. Peterson rightly declares that the cow's udder is the most important production unit in American agriculture. In that unit is manufactured the milk which accounts for one-fifth of the nation's farm income, and what is more important, from it comes the tens of millions of pounds of the nation's most important food.

Dr. Peterson reasoned many years ago that anything responsible for as much wealth and as much food as the cow's udder was worthy of study and understanding. That is why in his years as an undergraduate student and later as a graduate student he prepared himself to learn all he could of the mysteries of milk production—how the udder is developed, how the milk is secreted within it, and how to get the milk out of it.

At first the experimental work proceeded on the theory that a cow controlled the letting down of her milk voluntarily. An "ornery old critter" just didn't let her milk down simply because she didn't want to be that accommodating. But was it because she was stubborn? Experiments proved that it wasn't. Proof of this came when they cut the nerve that runs down to the mammary gland so that no mes-

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sage could be sent down that way. They found that there was no difference in the amount of milk let down at a milking or in the completeness of milking.

Suspecting that a hormone dumped from somewhere in the cow's body into the blood stream might be responsible for the milk flow, they proceeded to learn whether there was foundation for their suspicion. When they injected a hormone substance from the pituitary gland of a cow into the jugular vein at the junction of the head and neck, it took only 40 seconds before the teats were distended, indicating the milk had been let down.

Another series of experiments showed that the flow of the hormone into the blood, even though the cow hasn't been milked for several hours can be prevented by pain, fright, or anxiety. To study the effects of pain on the animal, one of the experimenters put a kitten on the cow's back. Neither kitten nor cow liked that.

Another experiment was the explosion of air filled paper bags behind the cow. Still another experiment contrived in order to learn whether the letting down of milk might be influenced by what the animal saw was the putting of a cage of rats in her manger. A fourth experiment designed to learn whether dumping of the hormone which affects the milk flow might be influenced by a cow's eagerness or anxiety for something was the putting of a loaded feed cart in full view of her, but not within reach. Although the effects of all these experiments were in general the same, they varied in degree. Pain, fright, and excitement caused most difficulty in getting a cow to let her milk down, and anxiety least. In fact, when they tried to milk the cow after the experiment with the kitten, the paper bags, and the cage of rats they would get just the small quantities that were in the cisterns just above the teats, and that was all. The hormone injected into the blood stream started the flow immediately, however, and the cow could be milked in three or four minutes.

Then they turned to the task of learning about good milking. Basically, what they set out to do was to provide the stimulus that would cause the cow to release the hormone suddenly and completely into the blood stream. They knew that this would be speeded up by handling the cows carefully and gently, by allowing in the barn only the men whom the cows knew and trusted, and by preventing exciting occurrences in the barn. They also knew that massaging the udder was helpful, but how long should it be massaged? It was discovered that the massaging of the udder, especially that part just above

the teats should continue for one-half to three-fourths of a minute, and then quickly washing the udder with the warm water did the trick best. But it was learned also that the effect of the sudden release of the hormone was soon dissipated—that unless milking began within a half-minute to a minute after the stimulation, the effect was lost. Fast milking, too, played a highly important part. If the milker wanted to dawdle at the job, the cow would accommodate him by letting her milk down slowly.

How helpful is this massaging and washing when done by milkers on the farm? We got the answer to that question from Henry Wildung. Mr. Wildung was considering selling half his herd. He was short of help, and the milking was being completed at a little after 7 o'clock each evening which meant too many working hours. Before selling he decided to try the massaging and washing method to learn whether it would materially cut milking time. Four men representing the manufacturer of the milking machine in use on his farm and who had had experience with the new, fast milking method, were as eager to observe its use on the Wildung farm as Mr. Wildung himself. Accordingly, one of the men went down the string of cows morning and evening the day before the new milking method was begun and clocked their milking time individually. Then they were clocked under the new method the following day and for two days thereafter. Milking time on the harder milking cows was more than halved, and on the easier milking ones about halved.

Under the old milking method in use on the farm, Ted Lustig, one of the men, would handle the three single unit milking machine, and Carl Johnson would strip back of the machine. Under the new method Johnson goes ahead of the machine massaging the udder for a half to three-fourths of a minute, and then washing it with water that is kept as near a temperature of 110 degrees as possible. In not more than a minute after this is done, the teat cups are shoved up on the teats and milking begins. It continues in usual fashion until the flow is what it would be when under the old method the teat cups would be pulled off and stripping begun, but instead of doing that the man handling the milker pulls the cups down on the teats a little way, and massages each quarter of the udder. That releases the last tiny drops of milk and the cow is milked dry with no stripping necessary. This same procedure is followed in both the Astroth and Clowes herds already mentioned.

The same procedure may be

followed just as easily in hand milking. Many hand milkers ordinarily start with massaging the udder anyway. Add the washing with the warm water and the pituitary gland up at the base of the cow's brain will dump its load of hormone into the blood stream, the muscles around the tiny cells in the udder will begin to contract and down will come the milk. But milk fast after that. If you don't the effects of the hormone will have passed, and the cow will milk just as slowly as ever.

He Used Fertilizer on "Weeds"

Condensed from Farm Journal and Farmer's Wife

BECAUSE he encouraged Johnson grass to grow rather than spend his energy and that of his helpers in killing it, K. G. Baker, superintendent of the Black Belt Experiment Station, Marion Junction, Alabama, came within an inch of getting "fired" eight years ago.

Dean M. J. Funchess, director of Alabama's experiment stations, threw up his hands in horror when he found that Baker was actually fertilizing and cultivating the grass, considered a weed by Alabama farmers ever since Colonel William Johnson planted it on a large plantation at Marion Junction 100 years ago.

He was amazed to find that Baker had even borrowed money on his personal note to purchase cattle to test his theory that "it is better to let cattle use Johnson grass than it is to try to keep it plowed and chopped out of cotton and cornfields." He was further provoked when Baker's system failed to show as much profit during the first two years as did row-crop systems in use at five other experiment stations in the state.

But Baker won out. After grazing cattle two years on permanent pastures, Johnson grass, winter legumes, early spring clovers, and feeding them small amounts of cottonseed meal during the winter, the income figures started climbing.

Farmers heard of the results, visited the station to learn more about the system, then went

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home and followed Baker's practices. As the years rolled by, more and more black-belt farmers in Alabama and Mississippi fell in line.

Last summer Alabama's black-belt farmers showed their appreciation by presenting Mr. Baker with a trophy for his "outstanding accomplishments." Long before this, Dean Funchess had frankly admitted that Baker had done an "almost unbelievable" job.

Today a large number of farmers in the black-belt area are using Baker's plan of raising beef cattle. Some farmers are actually planting Johnson grass on their farms. One seed company has stocked seed for sale.

Briefly, this is the way Mr. Baker and black-belt farmers use Johnson grass in a year-round grazing system:

One-half the land used in growing cattle is in permanent pasture; one-fourth is in Johnson grass, followed by Caley peas for winter grazing, and black medic for early spring grazing; the other one-fourth is in oats and barley. Johnson grass remains on the land three years, and in small grain for three years. Turning the land for oats keeps the grass vigorous.

About July the grass is mowed and stacked in the field in two-ton stacks. After cutting, the grass makes a second growth which stands in the fields until killed by fall frost. Three strands of barbed wire are stretched around the stacks and cattle are turned into the fields to graze the standing frosted grass.

After the frosted grass is consumed the temporary wire fence is removed so the cattle can eat the stacked grass. While on the frosted and stacked grass, each cow is given from one to three pounds of cottonseed meal daily, the exact amount depending on the condition of the cattle and the severity of the weather.

This means the cows are on permanent pasture during spring and summer; Johnson grass hay and frosted Johnson grass pasture during the early winter; Caley peas and black medic during the winter and early spring.

Cutting Dairy Chore Time Two Hours a Day

Condensed from Eastern States Cooperator

Digest of Bulletin 503 entitled, "Labor Saving Through Farm Job Analysis" obtainable through the Vermont Agricultural Experiment Station

WHAT can the farmer do to accomplish more every hour he works?

In today's manufacturing enterprises, engineers plan the position of machines to save every step and movement possible. Then technicians come along with stop watches and chart-making instruments and all the details of a job are measured, then studied and every unnecessary wrinkle in operations is ironed out. R. M. Carter of the Vermont Agricultural Experiment Station has applied this technique to the dairy farm. The farmer cooperating in the project is Leonard Clark, in Fletcher, Vermont.

Mr. Clark farms 150 acres—33 in crops and hay, 75 open pasture, 42 woodland. His livestock includes 22 grade Jersey cows, a team of horses and 20 hens. From his 1200 bucket sugar bush he made 225 gallons of maple syrup in 1942—and he cut 12 cords of wood for home use.

Working alone, except for seven days silo filling and wood sawing, Mr. Clark rolled up 416 man work units (each unit an average day's farm work) in 1942. On 448 Vermont farms 269 was the average—so you can see Mr. Clark was a hustler doing more than one-and-a-half times ordinary work even before the efficiency step-up was undertaken.

To get at the details Mr. Carter visited the Clark farm at intervals throughout the summer and fall of 1942. He drew a plan of the farmstead and the barn interior—measuring every feature—then he used a stop watch to time Mr. Clark at every part of his chores. He traced his steps on the drawing board plan of the premises. Result was a time table and travel map of chores as exact as the schedules and tracks of a railroad system.

Next, Mr. Carter did a lot of "thinking" and figured out ways whereby he believed Mr. Clark might save steps or short-cut his tasks. These were carefully worked out in theory and Mr. Clark adjusted the theory to practical considerations, then tried each new idea. Again the stop watch and "road map" were applied and the new results compared with the old way.

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Here are the operations in each chore on the Clark farm as they were being done at the close of the study.

"In addition to the specific operations listed, each job includes the travel to it from the point at which the preceding job was completed, and the travel to obtain or to return to place materials or tools used.

"1. *Operating milker.* Wash udders preparatory to putting machine on cows; transfer milker from one pair of cows to the next; rinse teat-cups between cows; move the rinse and carry pails along the walk as needed; dump milk from milker pail into carry pail.

"2. *Hand milking and stripping.* Milk cows by hand; strip after the machines by hand.

"Note: The expressions 'machine time,' 'stripping time,' and 'milking time' have been used in the text to refer to the time actually spent in drawing milk from the udder by machine, by stripping after the machine, and by hand milking. The chore jobs of 'operating milker' and 'hand milking and stripping,' 'like all others, include the travel from the point at which the preceding job ends to the place of work, and travel to put equipment in place.

"3. *Care of utensils.* Before milking, assemble strainer and place in can at milk house; carry milker pails and heads, milk pails, and rinse water to stable; prepare chlorine solution for rinsing teat-cups; assemble milking machine. After milking, draw rinse water through machine; take down machine; put teat-cups in rack and fill with chlorine solution; carry milker pails and heads and milk pails to milk house; take strainer apart and dispose of pad; get hot water from house; wash milker pails and place on rack; flush milk house floor with water.

"4. *Care of milk.* Carry filled pails of milk from stable to milk house; dump milk into can; return empty pails to position behind cows.

"5. *Cleaning during milking.* Scrape manure from platform into gutter during milking to prevent cows from soiling themselves.

"6. *Waiting during milking.* Idle time, due to waiting for machine to finish before removal from cows.

"7. *Care of injuries.* Any veterinary work done by the operator. As it happened, the only cases occurring during the period of observation were udder and teat injuries.

"8. *Graining cattle.* Feed cows and bull from grain box or cart; brush uneaten grain to within easy reach of cows.

"9. *Feeding silage.* Climb into silo; throw down silage with fork; carry silage to cows with basket or cart.

"10. *Feeding horses.* Feed horses hay from pile at foot of hay chute; feed grain from bag, using measure.

"11. *Cleaning horse stable.* Clean manure from under and behind horses with wheelbarrow and shovel.

"12. *Spraying cows.* Apply fly spray to cows.

"13. *Tieing cows.* Drive cows to place; clean droppings from walks; close stanchions; open and close doors, gate in cross alley, and rope barrier across feed alley as necessary. Includes time and travel within stable.

"14. *Releasing cows.* Open stanchions; drive cows from barn; clean droppings from walks; open and close doors, gate, and rope barrier as necessary.

"15. *Cleaning platforms and walks.* Clean litter and manure from platforms, walks, cross alleys, and service area into gutter, using brush, hoe, or shovel.

"16. *Cleaning feed alley.* Brush litter from mangers and feed alley.

"17. *Cleaning cow stable.* Shovel manure from gutter into wheelbarrow; wheel to end of ramp and dump into wagon; return to stable with wheelbarrow.

"18. *Spreading lime.* Get bag of lime at storage place; empty into wheelbarrow and dispose of bag; spread lime in gutter with shovel.

"19. *Bedding cattle.* Fill wheelbarrow at sawdust bin; wheel to stanchion line; spread along platforms and walks and in gutter with brush or shovel."

The whole story is exceedingly well told in Bulletin 503—and its summary is here quoted to show what happened in this demonstration of labor saving through farm job analysis:

"The work on the Clark farm was begun June 29, 1942, and the various changes and adjustments were put into effect over a period of about four months. These can be listed under four general heads, as improvements in barn arrangement, in equipment, in work routines, and in the positioning of equipment and supplies.

"*Barn rearrangement.* The principal changes in the barn were (1) placing the cows in two nearly equal rows instead of in a long and a short row; (2) opening a cross alley at the north end of the stanchion line, so that it was possible to pass completely around the cows in the performance of a given chore job; (3) cutting a new door in the east wall of the barn; (4) moving the horses from the west side of the barn to the northeast corner, near the new exit door; (5) removing the partition from around the sawdust bin and silage chute.

"*Improvement of equipment.* The principal items of new equip-

ment were a grain cart, silage cart, specially designed wheelbarrow, teat-cup rack, and rinse-pail carrier. Changes were also made in small tools, as the grain scoop, silage fork, floor brush, shovel, and hoes.

"Improvement of work routines. The main changes in routines were the inauguration of a four-minute milking machine interval and the development of quick stripping habits in cows and milker. Many small changes, designed to hold unproductive travel and work to a minimum, were made in methods and in the order of operations and jobs.

"Improved positioning of equipment and supplies. The matter of good work routines and that of positioning of equipment and supplies are closely related. Two work centers were established, one for general chores, and the other for milking. The first is in the northwest corner of the barn. Here the silage chute and the sawdust bin are located, grain and lime are stored, and the grain cart, silage cart, wheelbarrow, and the forks, shovels, and brushes are kept. Most chore jobs with the cattle except milking, start in this area, move either around the barn in a circuit of

DAILY TIME AND TRAVEL DURING CHORES

	June 29, 1942*		Oct. 21, 1942*		Savings	
	Time Minutes	Travel Feet	Time Minutes	Travel Feet	Time Minutes	Travel Feet
Milking jobs**	195	5699	118	2896	77	2803
Care of milk utensils	42	2362	23	827	19	1535
Graining cows	6	771	6	293	..	478
Feeding silage	26	2070	15	199	11	1871
Feeding horses and cleaning horse stable	12	1112	7	398	5	714
Tieing and releasing cows	9	982	9	710	..	272
Spraying cows	3	457	3	283	..	174
Cleaning alleys and walks	14	888	11	295	3	593
Cleaning cow stable	19	1180	15	345	4	835
Spreading lime and sawdust	18	1679	12	299	6	1380
Total	344	17,200	219	6545	125	10,655

*Silage was not being fed on either June 29 or October 21, and the cows were not sprayed nor was lime spread in the gutters on October 21. For these jobs the comparisons are between dates as follows:

Feeding silage—November 18, 1942, and January 14, 1943
Spraying cows—June 29 and September 17, 1942
Spreading lime—June 29 and September 17, 1942

**Clean during milking, care for milk, operate milker, wash udders, hand milk and strip, wait during milking, care for injured teats.

the stanchion line, or up the center feed alley and back, and end near their starting point. The second work center is at the southwest corner of the barn. Here the milker is assembled before and rinsed and taken down after milking, teat-cup rack and the switch which controls the milker motor are located, and the pulsator, air hose, milking stool, and rinse pails kept when not in use. The milking starts with the first two cows in the nearby row and moves around the barn in a clockwise direction.

"No attempt was made to measure or to estimate the reduction in fatigue which accompanied the adjustments in barn chores, but there is reason to believe that it was greater than that in the time, that the chores not only took less time at the end than at the beginning, but that the work was more easily done. The evidence of this lies in the reduction in loads carried, in the fact that the decrease in travel was much greater than that in time, and in the testimony of the operator that the work has been made easier.

"In terms of hours and minutes the reduction in time was from five hours 44 minutes to three hours 39 minutes, a saving of two hours five minutes; in terms of miles that in travel was from 3.25 to 1.25 miles, a saving of 2.0 miles. These savings represent 36 and 62 percent, respectively, of the original time and travel. Two hours a day is equivalent to more than 60 12-hour days a year, a good full two months work; two miles a day is equivalent to 730 miles a year."

Mr. Carter discusses some practical suggestions for those who want to do a little job analyzing for themselves. He says, "Men differ and farms differ. Mr. Clark's plan of work, exactly as it is in every detail, is not likely to fit many individual situations. On the other hand, many of the changes made on his farm can be made just as successfully elsewhere. The method used in studying the problem, in planning changes to make the work easier or to save time, and in putting them into effect, can be used anywhere. This does not imply resort to a stop watch, which was necessary in the station's trials in order to insure accuracy. If, however, a man will watch himself, or get someone else to watch him, while he is doing his chores, with the definite purpose in mind of searching out ways of saving time and work, he will be well rewarded.

"Fully realizing that experience secured on one farm cannot be expected to afford all the answers, and that the program outlined is far from perfect, certain suggestions are offered of specific things to do to improve barn chore work.

"1. The first and foremost requirement is a real desire to save time and to find easier ways of doing the work. If you are satisfied with things as they are and feel sure that no improvement is possible, right here is as good a place as any to stop.

"2. If there is someone that you can get to do it, who has good judgment and whose suggestions you will not resent, have him or her watch the chores as they are being done. An outsider will often see things which escape the attention of one who sees them every day.

"3. Draw a plan of the barn to scale and mark on it the location of tools and supplies. Small changes that will save steps may show up more clearly on a diagram than they do on the ground. Especially if some major rearrangement is being considered, study the possibilities carefully on paper before coming to a decision.

"4. Take advantage of opportunities for small savings even though they may seem unimportant. They count up surprisingly. A good share of the two hours saving on the Clark farm came a minute or two, or less, at a time.

"5. Since milking is the most time-consuming of all chore jobs, and the one in which there is the most repetition, a careful survey of its conduct is especially important in any effort to save time. If you use a machine, make sure that the pulsation rate and the vacuum, at the teat-cups as well as at the stanchion line, are in accordance with the manufacturer's recommendations. See that the inflations are in good condition, free from checks and pinholes, and that they fit smoothly into the shells. A good job of milking cannot be done with a machine that is out of adjustment.

"Quick milking and quick stripping are cornerstones of good milking procedure, and essential parts of any program which seeks to economize on labor in doing barn chores. Check on the time the machine is on each cow and on the time it takes to strip each cow. Some member of the family can do this, using an ordinary watch or clock.

"Most cows can be trained to milk out in three to five minutes. If you are leaving the machine on longer than this, serious consideration should be given to an effort to work the interval down to that level. Study each cow; leave the machine on each no longer than is necessary. Control of the machine interval by the watch is not the only way of doing a good job of milking but it is a sound method, simple, effective, and much better than those now commonly used to indicate when the machine should come off.

"Judging by the limited data available, the time needed to strip varies widely from cow to cow, and may differ from time to time with the same cow. After the Clark farm cows had become thoroughly adjusted to the new milking routine it averaged about one-half minute per cow. There is less basis for a definite statement on stripping than on machine time, but certainly if it averages as much as a minute per cow in your herd, you should take steps to lower it.

"6. Take each chore job, and then each operation within each job, in turn and study its possibilities. Ask yourself first whether the job or operation is really necessary, what useful purpose it serves, what would happen if it were entirely omitted. This question has not been raised in connection with the work on the Clark farm, where the sole purpose has been to find ways of doing the same chores in less time and with less work, but it needs to be considered. Most jobs, and indeed most operations, obviously must be continued, but there is enough difference in the work that men do in caring for their cattle, enough instances of men getting along without doing certain chores which others consider necessary, to give point to questioning each in turn. For example, Mr. Clark formerly stripped only part of his cows, but it was deemed wise to strip all of them when the transition to a four-minute machine interval was undertaken. Now that the new milking routine is firmly established, should he go back to the original plan of stripping only those that seem to need it? Or possibly give up stripping entirely? What would be gained by doing so? What would be the disadvantages, the risks? Similar questions may be raised about rinsing teat-cups in two waters each time they are moved from cow to cow.

"Go over each job in detail, one at a time; think about the work as you do it; think about it as if it were new to you, as if you were planning it for the first time. Are there any frills that could be left off without loss? Are the tools used adequate and fitted to the work for which they are used? Are they conveniently placed?

"In particular, each time you find yourself walking to get a tool or to return it to place, or to get to some place to start a piece of work, ask yourself how the trip can be avoided; look upon all such travel as a challenge. Relocation of tools, additional tools, some change in barn arrangement, some change in plan of work, any one or several of these may be the answer. In like fashion, whenever you find yourself carrying a weight, consider whether there is not some practical way to transfer it to wheels.

"7. Give thought also to the order of work, to the manner in which jobs fit together. The main outlines of the work plan are largely fixed by the needs of the stock, but some slight change may save a trip the length of the barn, or shorten some operation by a few seconds. Changes proposed in one job may affect others as well, and routines should be planned in the interest of the greatest total saving.

"8. Since work routines cannot be studied apart from their settings, this leads back again to a consideration of barn arrangement. Checking your barn against the 'Dairy Barn Layout Score' may call your attention to points that need improvement, and suggest desirable changes. Careful thought should be given to any major rearrangement before it is undertaken.

"9. Don't try to work out some elaborate reorganization of the work before making changes. Put them into effect one at a time as you see places where improvement is possible and ways to bring it about.

"10. Remember that when a change is made the effect on the time taken to do the job may not appear at once. More often than not the worker has to become accustomed to the new method or the new arrangement before any saving becomes manifest.

"11. Note the time that it takes to do the different jobs so that you can judge of the progress made. As has been said, detailed and elaborate notes like those kept on the Clark farm are not necessary, but a reasonably accurate record of the time taken to get ready for milking, to milk, to feed, etc., will be of much service. The same can be said of a fairly careful estimation of the distances walked in the course of each job, which often is particularly revealing.

"Finally, remember that the job is never done. No man will ever do his work so well that further improvement cannot be made. Keep your eyes open for ways to make your work easier. Be receptive to ideas, but also be critical of them."

Corn in the Kudzu

Condensed from Southern Agriculturist

R. Y. Bailey

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THE loess hills extending from southwest Mississippi northward through western Tennessee and Kentucky present a serious problem of soil wastage. The highly erodible nature of the soil material on these steep slopes points the way to eventual destruction of a vast acreage of rich land, if present cropping practices are continued.

From a soil conservation standpoint, it would be easy to say, "Don't cultivate deep loess soils on slopes of more than 5 percent." Farmers, however, must cultivate at least a portion of their steep land in order to get enough acreage for certain crops. This leaves soil conservationists the problem of finding a way to save the soil on steep slopes and at the same time allow crops to be grown on them.

Like many other problems, this one seems to have a local answer. A simple rotation of kudzu and corn that is being used with almost startling success near Port Gibson, Mississippi, may be a solution.

In 1936 kudzu was planted on several of the steepest, most severely eroded slopes of deep loess in the demonstration project area of the Soil Conservation Service at Port Gibson. Farmers allowed kudzu to be planted only because they thought the land was too far gone to be of further value for crop production. After a few years under a dense growth of kudzu the gullies were filled, and farmers began wondering if they possibly had been too hasty in their judgment when they gave this land up for lost.

In the spring of 1941 Ira W. Carpenter, District Conservationist of the Soil Conservation Service at Port Gibson, decided to take a chance on one of the steep slopes on his farm. He plowed the land during the winter to get kudzu crowns for planting additional acreage, thus the land was prepared for corn as a by-product of harvesting crowns.

Corn was planted in the spring and, as Carpenter expressed it, the plants were as "black as the ace of spades" during the grow-

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ing season. Farmers and agricultural workers beat a path to Carpenter's door to see his corn that grew so green and tall on land that was once considered too far gone for further cultivation.

Carpenter's visitors did a lot of guessing about the yield of corn, many of them going as high as 75 bushels in their estimates. The measured yield at harvest time was 61¾ bushels per acre.

Another slope on which kudzu was growing was plowed for crowns in the winter of 1942 and was planted to corn in the spring. Again the corn was so outstanding that it was visited by large numbers of farmers and agricultural workers. The estimates of yield records were not taken in 1942, but Mr. Carpenter believes he made a little more than he did in 1941.

By the time frost fell on the vines in the fall, a good stand of kudzu was back to protect the soil from further erosion. In the summer of 1943, the slope that grew 60-bushel corn in 1942 was again covered with a dense stand of succulent forage that was available for either hay or pasturage.

The slope across the draw from the one plowed in 1942 was plowed for crowns and planted to corn in the spring of 1943. This corn is making another big yield, and a good stand of kudzu was reestablished within two months after the middle of corn was "laid by," the middle of May.

In reporting on his kudzu-corn rotation Mr. Carpenter said, "I sold $97.50 worth of kudzu crowns per acre in 1943. The corn where these crowns were harvested looks as if it would make 75 bushels per acre. Kudzu where 60 bushels of corn per acre grew in 1942 is back as good as ever and looks as if it would yield about three tons of hay per acre. Last, but not least, I feel safe in helping farmers in the soil conservation district where I work to protect their steep slopes and increase production with kudzu rotations. I have done it successfully three successive years on my own farm. I am not guessing."

Maybe Carpenter has something on his steep slopes that will have wide application over the extensive area of this highly productive, erodible soil. The simple rotation that is working so well on his farm may be the answer to the problem of protecting this unstable soil and at the same time allowing its continued use for cultivated crops.

A Ten-Year Program in Its Fifteenth Year

Condensed from Farm and Ranch

Frank A. Briggs
Editor

WHEN the citizens of Lamar County, Texas, some fifteen years ago, came to the conclusion that agriculture was their chief asset, and that their future depended largely on balanced production, they proceeded to lay plans for a more complete development of their soil resources. Up to that time Lamar County had majored in cotton almost to the exclusion of livestock and other crops.

It was no easy matter to come to an agreement regarding the steps to be taken. They realized that farmers must have a market for any new commodity produced or else they would go back to cotton. It was argued that there was always some kind of a market for cotton. Then some one spoke up and said there should be a market for livestock and for milk and cream, and steps were immediately taken to organize a creamery company. Others wanted to promote beef cattle, sheep and hogs and wanted to jump right into it. At this point A. L. Edmiaston, county agent, held up a staying hand. "Let us look before we leap," said Edmiaston. "We can't go too fast. It will take ten years to get under way. Let's have a ten-year plan and then go to work, building substantially as we go. Our farmers are not ready for taking on livestock. Certain conditions must be met before I will suggest any farmer change over to a balanced program with livestock as a major project. Here are my conditions.

"First, he must provide for an abundant water supply conveniently located; second, bountiful improved pastures properly fenced; third, production of all the hay and forage on the farm to be fed on the farm; and fourth, facilities for the utilization of home-produced grains. To this I might add adequate shelter from storms and cold winds."

It is that kind of leadership that broke up the one-crop system of farming in Lamar County, and in the course of a few years developed a balanced program with livestock as one of the major projects. This program has given Lamar County a top position among counties in the Southwest in agricultural progress. It has also been a sustaining factor in

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maintaining a high business level in the city of Paris and other trading centers in Lamar and adjoining counties.

The planning and developing of this program was not a one-man job. The county agent had a lot of help. To list all who so enthusiastically participated would be like publishing a business directory of the city of Paris. Yet, there were outstanding citizens and organizations more prominent in the move than others, among them being the Chamber of Commerce, representing the leading business interests of the city, and the Lamar Creamery Company, the latter majoring on the development of the dairy interests. There were also many prominent farmers who joined enthusiastically in the program to remodel and streamline Lamar county agriculture.

The Lamar program was not the result of regulated acreage by the Government because it was started in 1929 before we had a Triple A. It resulted from a study of the agricultural resources of the county and from a knowledge that the one-crop system was unprofitable. Farmers were becoming conservation conscious and readily accepted a program that would conserve the soil and at the same time increase and regulate the flow of income.

The program was started with the idea of reaching certain goals within a period of ten years. The ten years were up in 1939, but the program goes on. In the beginning a record was made of just what the county had in livestock numbers, in improved pastures and in acres of crops. These records were made every year and in 1939, ten years after the program was launched, a comparison was made. Another was made in 1943, and in the table we present the record of progress in terms of acres and numbers.

The Dairy Industry

You will note in the records that in 1929 there were 6,340 cows in the county milked commercially. Not enough milk and cream were produced to supply the local demand. Now there are 12,000 head, not counting the family cows, and enough milk is produced to supply not only the home population, but from sixty to seventy thousand soldiers in the nearby camp.

Relative to this industry, we quote Ernest M. Peyton, in the Paris *News*.

"More than a decade ago, a campaign was waged in this area to sell $20,000 worth of stock in Lamar Creamery Company to get a whole milk market for Paris and the surrounding area. Last year this company did more than a million dollars worth of business, and now is buying 80,000 pounds of milk every day and is seeking more.

	1929	1939	1943
Dairy Cattle (No.)	6,340	9,800	12,000
Beef Cattle (No.)	1,800	11,000	23,000
Hogs (No.)	12,227	21,300	40,000
Sheep (No.)	416	7,600	
Poultry (No.)	100,000	150,000	300,000
Improved Pastures (Acres)	400	17,000	100,000
Home Orchards (No.)	700	1,700	2,500
Corn and Oats (Acres)	80,000	110,000	
Hay (Acres)	14,000	34,500	
Home Gardens (No.)	2,100	4,300	Increased in size
Canned Foods (Cans)	30,000	144,369	200,000
Truck Crops (Acres)	450	2,600	3,000
Trench Silos (No.)	3	312	Enlarged
Cotton (Acres)	131,000	92,000	87,500
Peanuts (Acres)	300	1,700	6,000

"In 1940 there were 16 dairy barns in the Paris milkshed that were eligible for a Grade A rating. Now, there are 94, with each barn and dairying equipment representing an average daily outlay of $15,000.

"About 3,500 pounds of Grade A milk were purchased here daily three years ago. Now, the dairy purchase locally of Grade A milk is 38,000 pounds.

"It has been authoritatively estimated that Lamar County's dairy farmers now are selling about $3,500 of milk products daily, exclusive of dairy cattle raised and sold here."

Jersey cattle predominate, but importations of Holsteins from Wisconsin are giving that breed a good start. There are also a number of Guernsey herds.

The number of beef cattle increased from 1,800 in 1929 to 11,000 in 1939 and to 23,000 in 1943. That industry has prospered despite the shortage of protein feeds. Improved pastures—improved by mowing and by planting various legumes—plus a good water supply, are large factors in making beef cattlemen happy at this time. Like other sections, there probably will be a reduction in numbers due to a shortage of feed and grass, but the plan being followed will leave the best animals at home. Culls go to market first. Thus far it is a Hereford county, but the Angus is finding favor on a number of farms. Some of the best blood to be found has been brought into the county, and now many sales of breeding stock are made to livestock men in other sections of the Southwest. About 250 registered Aberdeen-Angus cattle have been brought into the county.

At one time Lamar county farmers showed quite an interest in sheep, but interest is slowing down. There are only a small number in the county at the present time. The demand for pork and lard put many farmers into the hog business before the ratio between feed costs and hogs narrowed. There were some 40,000 head in the county at the last count.

Will They Plant More Cotton?

In view of the opportunity offered farmers to plant all the cotton they want to in 1944, will the Lamar county cotton acreage be materially increased? This question was asked County Agent Edmiaston. He does not think so. "Some of our larger farmers in the blacklands may increase if prices hold up. We may expect some increase in other sections, but it is my opinion that the balanced farm program has been too well sold to be broken up. Lamar County is going ahead with its livestock industry, producing fewer beef cattle and hogs for a time after the war, perhaps, but of better quality. We find that our program gives us a better distribution of labor and income. All of our eggs are not in one basket."

Silo Granary

An old octagonal silo, made of 2 by 4's laid flat, was converted into a granary by Harry Muir, Faribault county, Minnesota. Corrugated steel was laid over the walls. An outside pit for an elevator was dug at the base of the silo. Grain is removed by spouting.

—*Capper's Farmer*

Use More Bromegrass

Condensed from Farm Science Reporter

Maurice E. Heath

BROMEGRASS may not sound like a war emergency crop, but it can make a real contribution toward our effort for maximum food production. Providing feed for livestock is one of our problems now and an acre of good bromegrass pasture will feed as much livestock as 1½ to 2 acres of bluegrass, say some Iowa farmers who have tried it. So in this period, when we are trying to make every acre of land produce to capacity, we need to look into the possibilities of providing more productive pastures.

Bromegrass (*Bromus inermis*) can probably make its greatest contribution as either a pasture or hay crop if used in combination with alfalfa. Bromegrass-alfalfa is highly nutritious and palatable to all classes of livestock when used as a rotation pasture. Alfalfa used alone for pasture is a bloat hazard, but when bromegrass makes up from one-third to one-half of the forage mixture, bloat is practically if not completely eliminated.

The bromegrass-alfalfa combination provides for a longer period of grazing than other pasture grasses and legumes and not only furnishes an abundance of forage but is an economical source of protein.

It is best to pasture the bromegrass-alfalfa judiciously, not closer than 5 to 8 inches, so as to prevent injury to the alfalfa stand. Bromegrass is a heavy user of nitrogen and therefore should always be grown with a legume, preferably alfalfa. A stand of bromegrass when grown alone for 3 or more years without a legume often becomes unproductive. This condition is commonly referred to as being "sod-bound." Bromegrass can be grown with alfalfa on any soil properly treated and suited to the growing of alfalfa. The meadow should be allowed to recover sufficiently in the fall to furnish adequate winter protection.

A mixture of bromegrass - alfalfa is especially useful on the more rolling to steeply rolling cropland fields which are subject to serious sheet erosion. On such land, rotations may vary from 4 to 8 years in length. These rotations usually provide 1 to 2 years of corn and 2 to 4 years of brome-

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grass-alfalfa. The seeding rate of alfalfa can be reduced from one-third to one-half when sown with bromegrass. Greater yields of clean-tilled crops can be expected following bromegrass-alfalfa if plowed before the alfalfa disappears or becomes too thin.

In the Knox-Marshall soil area in western Iowa, where alfalfa grows very vigorously, 4 to 6 pounds of alfalfa and 12 to 15 pounds of bromegrass seed per acre have been a desirable mixture for rotation pasture. If it is to be cut for hay, it may be desirable to use a little less grass and more alfalfa seed. In other areas of the state where bromegrass grows more vigorously, the seeding rate may range from 5 to 10 pounds with 6 to 10 pounds of alfalfa seed per acre. Where the land is more gently rolling, greater use should be made of the shorter rotations which provide not less than two years of bromegrass-alfalfa.

Soil loss studies from various Soil Conservation Service Experiment Stations show grass to be from 500 to 2000 times more effective in protecting the soil on sloping fields from erosion than continuous corn planted up and down the slope. The soil protection will be greater when the rotations are lengthened on sloping fields and the amount of grass is increased. Contouring of clean-tilled crops, and contour strip cropping where applicable, will give additional protection in reducing soil losses.

Bromegrass is fibrous rooted and each plant produces literally many miles of roots and rootlets. These roots hold and bind the soil like "hair in the plaster." Alfalfa is tap-rooted and the entire plant decomposes rather quickly when plowed. Because of the tap-rooted nature of alfalfa, it does not produce effective soil protection when used alone on rolling to steeply rolling land. Thus a fibrous rooted grass such as bromegrass when used with alfalfa produces very effective protection against sheet erosion. When a good bromegrass-alfalfa sod is plowed, the effect of the bromegrass roots is immediately apparent—they hold the plowed soil together. This binding effect also carries over to a considerable extent the second year when the field is in clean-tilled crops.

The spreading root system of bromegrass together with the surface protection it produces make it an excellent grass for use in terrace outlets and grassed waterways. Where the soil is low in fertility, especially nitrogen, an application of barnyard manure following seeding is highly recommended. Care should be taken during the seedling year to prevent the concentration of water in the waterway or terrace outlet channel. A good time to seed

bromegrass in waterways is when the field is going to small grain in the spring. Oats have considerable seedling vigor and furnish field and waterway protection while the bromegrass is becoming established.

Field borders of bromegrass sufficiently wide on which to turn with ordinary farm equipment are recommended where contour farming is practiced. This will eliminate end rows of clean-tilled crops. The bromegrass may be cut for hay or used for early spring and late fall pasture. Such areas may also be a source of bromegrass seed.

Bromegrass is well adapted for use on spoilbanks along drainage ditches, and should be included in all the mixtures seeded for such purposes. It not only furnishes bank protection but it stops spreading at the waterline. The Iowa Highway Commission is using bromegrass extensively in all its grass and legume mixtures in the re-vegetation of sloping right-of-ways on state and federal roads. When establishing vegetation on slopes from 3 to 1 to as steep as 1½ to 1, an application of mulch such as straw or strawy manure has many times been the difference between success and failure. The mulch increases infiltration, reduces runoff, decreases sheet erosion, and assures better stand and growth of vegetation.

In fence rows where there is little or no grass, the weeds may be practically eliminated by establishing such areas to bromegrass. Fence rows in bromegrass not only reduce the labor of cutting weeds, but such areas are a source of grazing in late fall and early spring.

There are many factors which may contribute to a seeding failure or a thin stand of bromegrass. These include lack of a firm seedbed, prolonged drouth in the seedling stage, honey-combing and drying out of seedbed in the spring following a fall seeding, insect damage (grasshoppers and chinch bugs), covering the seed too deep (over ¾ inch), too late seeding in the spring, excessive competition from weeds or small grain, and the planting of unadapted strains.

We need more farmers producing more high quality seed of adapted bromegrass strains. Until an adequate seed supply is available at a reasonable price, bromegrass will not spread as rapidly as it should. When a bromegrass stand is established for seed production, we recommend that it be sown with a light seeding of alfalfa. The stand should show a predominance of bromegrass. Alfalfa seeded at the rate of 3 to 5 pounds, depending on the location, and 10 to 12 pounds of bromegrass seed per acre, has been found a satisfac-

tory mixture for bromegrass seed production. When grown in this manner, it is not unusual to obtain yields of 400 to 700 pounds of bromegrass seed per acre, which is worth $60 to $100 an acre at present prices. Old alfalfa stands that are becoming too thin for hay production may be disked or spring-toothed in the fall and seeded to bromegrass for seed production, pasture, or both.

Bromegrass may be harvested for seed with a binder and threshed. Probably the simplest and most convenient way to harvest bromegrass for seed is with a combine. Those with a rubber-faced bar type cylinder and concaves are preferred because they do not break the stem or straw in so many pieces as do the spike-toothed type of cylinder and concave.

The combine should be set to head the brome above the alfalfa, thus leaving all the stems and leaves for hay or pasture following the seed harvest. Be sure to reduce the wind in the combine to prevent loss of seed, since the seed is almost as light as the straw. Where the yield of bromegrass seed is heavy it may be necessary to reduce the width of the cut to prevent overloading the combine.

Combined bromegrass seed should be spread on a suitable floor space to dry. The seed should be stirred daily the first 3 or 4 days to prevent heating. When thoroughly dry, the seed can be cleaned if necessary by re-running it through the combine or by the use of a small fanning mill.

Oiling Overhead Hay Pulley

When the hay-rope pulley at the top of the barn needs oiling, tie a piece of burlap to the rope and soak it well with oil. As the burlap is forced through the pulley, the oil is squeezed out and runs over the sides of the pulley and soon works into the bearing. This does the job just as well as you could by climbing up there and using an oil can, and you eliminate the danger of falling.—E. W. E., Chisago Co., Minn.

Purdue Swine Day

Condensed from American Hampshire Herdsman

IT was conclusively proved in Purdue University experiments summarized at their annual Swine Day in September, that good protein supplements conserve feed grains, protect the economy of production and increase the rate of gain and uniformity of finish in hogs.

Feeding of supplemental mixtures containing no more than 35% protein—with as little as only 2.5% animal protein such as tankage, meat and bone scraps or fish meal—gave excellent results in Purdue feeding trials. Results of these feeding experiments were summarized at Lafayette, Ind., by C. M. Vestal of the Purdue animal husbandry staff.

War conditions necessitate the conserving of feeds, especially protein feeds. The voluntary cooperation program for conserving protein feeds limits the total protein to 35% and the animal protein to 3% in supplements for growing and fattening hogs. Since the important protein feeds commonly used in hog feeding contain more than 35% protein, they must be combined with other feeds of lower protein content in order that the resultant mixed supplement shall contain not more than 35% protein.

How far can we go in diluting efficient protein feeds with low-protein feeds such as feed grains, mill feeds and mineral mixtures without interfering seriously with the growth and fattening of hogs and the economical production of pork? Also, can these low-protein feed mixtures be fed satisfactorily free-choice with corn?

Drylot Feeding

On basis of comparative feeding results in drylot, this 20% supplement was classified as POOR:

Soybean oilmeal	15
Ground oats	40
Ground wheat	15
Alfalfa meal	10
Cottonseed meal	5
Meat & bone scraps or tankage	5
Minerals	10

This 25% supplement was classified as FAIR:

Soybean oilmeal	30
Ground oats	25
Ground wheat	15
Alfalfa meal	10
Cottonseed meal	5
Meat & bone scraps	5
Minerals	10

These three emergency supplements gave GOOD results when self-fed, free-choice, with shelled corn and a mineral mixture composed of 10 pounds pulverized

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limestone, 10 pounds steamed bonemeal, 1 pound common salt:

30% Supplement

Soybean oilmeal 45
Ground oats 10
Ground wheat 15
Alfalfa meal 10
Cottonseed meal 5
Meat & bone scraps 5
Minerals 10

35% Supplement

Soybean oilmeal 60
Cottonseed meal 10
Alfalfa meal 10
Ground wheat 5
Meat & bone scraps 5
Minerals 10

35% Supplement

Soybean oilmeal 40
Cottonseed meal 30
Alfalfa meal 10
Ground wheat 5
Meat & bone scraps 5
Minerals 10

The three foregoing supplements compared favorably with famous Supplement 5, which in normal times was recommended by Purdue: soybean oil meal 40, meat & bone scraps 20, fish meal 20, cottonseed meal 10, alfalfa meal 10. It contained 21% animal protein, as compared with 2.5% for those above.

On Pasture

Each of the following supplements was self-fed, free-choice, with shelled corn and a mineral mixture of 10 lbs. pulverized limestone, 10 lbs. steamed bonemeal, 1 lb. common salt, to hogs on pasture.

This 20% supplement gave POOR results:

Soybean oilmeal 10
Ground oats 50
Ground wheat 15
Cottonseed meal 10
Meat & bone scraps 5
Minerals 10

This 27% supplement conserved protein-rich feeds at the expense of rate of gain so must be considered UNSATISFACTORY:

Soybean oilmeal 35
Ground oats 25
Ground wheat 15
Cottonseed meal 10
Meat & bone scraps 5
Minerals 10

These 35% supplements gave GOOD results:

Soybean oilmeal 60
Ground wheat 15
Cottonseed meal 30
Meat & bone scraps 5
Minerals 10

and

Soybean oilmeal 40
Cottonseed meal 30
Ground wheat 15
Meat & bone scraps 5
Minerals 10

The former of these two proved to be more efficient. Both compare favorably with famed Purdue Supplement C of pre-war days: soybean oilmeal 40, meat & bone scraps 20, fish meal 20, cottonseed meal 10, linseed meal 10.

Feed your corn with other grains. It will go farther and needs less grain. That is the advice of Purdue University animal husbandmen. Here are their suggested grain mixtures for hogs:

Bred Sows (winter months): (1) ground corn 60 lbs., ground oats 35 lbs., supplement 5 lbs. (2) ground corn 35, ground barley 35, ground oats 25, supplement 5. Avoid the use of rye in gestation rations. Give sows access to good alfalfa or clover hay and a mineral mixture.

Sows and Suckling Pigs: (1) ground corn 70, ground wheat or oats 20, supplement 10. (2) ground corn 30, ground wheat 30, ground barley 30, supplement 10. (3) ground corn 50, ground wheat 20, ground oats 20, supplement 10. (4) ground corn 40, ground wheat 30, ground rye 20, supplement 10. Supplement should contain alfalfa meal for drylot feeding. Give sows and pigs access to good mineral mixture.

Growing and Fattening Hogs: (1) ground corn 75, ground oats 25. (2) ground corn 50, ground wheat 50, ground oats 25. (3) ground corn 50, ground oats 25, ground rye 25. (4) ground corn 25, ground wheat 50, ground rye 25. (5) ground corn 25, ground wheat 25, ground oats 25, ground rye 25. (6) ground corn and ground wheat in any proportion.

Ten to 15 pounds of a 35% protein supplement should be added to each 100 pounds of grain mixture for weaned pigs until they reach 75 lbs. From then on during the fattening period, the supplement can be fed free-choice with the grain mixture.

Values of Corn for Fattening Hogs

When shelled corn is worth $1.00 a bushel: Ground wheat is worth $1.13. Ground barley is worth 79c. Ground rye is worth 90c. Ground oats is worth 40c.

Wheat, barley, rye and oats should be ground. Medium to coarse grinding is recommended. It is not necessary to grind corn except for mixing.

Pebble Floor Sun Pen

Many poultrymen would like to get their hens outdoors into direct sunlight if they had a way to prevent worm infestation. Harry Burns, Tuscola county, Michigan, says he has solved the problem. He built outside pens at the south of a laying house after covering the ground 6 inches deep with coarse gravel. Droppings work down into the gravel where worm eggs are out of reach.

—Capper's Farmer

Fighting Off Starvation

Condensed from Kansas Farmer

THERE will be few full stomachs in Russia until the war is won. The Russian wartime diet provides about 1,600 calories a day, compared to 2,500 in Britain and 3,000 in the U. S. And 90 per cent of the calories in the Russian diet are from bread, cereals and potatoes.

The Russian civilian these days works 12 to 14 hours a day, 6 days a week, on an average daily diet of 1 bowl of thin soup; less meat, fish and poultry combined than the amount of meat in 1 hamburger; a single serving of potatoes; a single serving of cereals; one loaf of bread; 3 hard candies, or little more sugar than one teaspoonful.

These are the conditions under which Russian people are carrying on their fight against the Nazis. For 2 years they have gone hungry and in the battle against hunger Russia's farmers face heavy odds.

By October, 1942, Axis armies had occupied only 7 per cent of Russian territory, but in that 7 per cent lay the most productive acres in all Russia—acres that produced about 40 per cent of Russia's agricultural products.

Into the hands of the enemy fell about two fifths of all the pre-invasion grain and cereal acreage; including three-fourths of the high-yielding winter wheat; 40 per cent of the rye—the staple bread grain of Russia—and 60 per cent of the barley. In addition the Russians lost about half their potato fields, 85 per cent of their sugar beet acreage and 60 per cent of the area producing sunflower seed, Russia's most important source of vegetable oil.

Since all of these foods are basic among Russia's wartime needs the situation would be comparable to loss in the U. S. of our Midwest states of Kansas, Missouri, Illinois, Iowa, Wisconsin, Minnesota, Nebraska, South Dakota and North Dakota—states with huge grain and variety crop production.

When the Nazis struck this vital area of Russia's agriculture the farmers and the government were confronted with many grave problems and momentous decisions. First, all the crops possible must be harvested and saved; all crops that could not be saved must be destroyed under the "scorched earth" policy, and the farmers and farm machinery must be removed to a new and safer location where they could

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continue to produce the much-needed food.

It was a common sight in the first months of the German invasion to see Russian soldiers helping farmers harvest their crops and helping to remove them from the area before continuing into the front line battle.

There were 80 million Russians living in the area threatened most seriously by the German invasion. At least half of them were removed from the area in one of the most fantastic migrations in history.

Most of the 40 million who escaped from the Nazis during the four months it took to move them left their homes with little more of their personal possessions than they could carry on their backs. Millions did not have time to gather their winter clothing. They suffered and died by the thousands as they traveled from 1,000 to 3,000 miles to set up farming anew on Siberian soil, in a winter of 50 degrees below zero.

American correspondents reported in those early months that they saw long trainloads of farm and industrial machinery going to the rear, and in most instances the farmer and his family rode on the flat cars with their tractors and their combines. These farmers encountered terrible hardships but they escaped the scream of Nazi bombs, and the terror of Nazi overlords, the forced labor, humiliation and cruelty of Hitler's New Order; and their spirit was firm. "There was almost unbelievable misery among the refugees, but no spirit of defeatism," wrote Quentin Reynolds, famous correspondent.

A decade of pioneering to open up new lands of Russia's East paved the way for the gigantic trek of war refugees. There are serious climatic and soil limitations upon agriculture in Eastern Russia. Nevertheless, Russia's agricultural administrators looked to the East, for they knew that much of the richer western farmlands could be laid waste by a modern army on wheels.

With this fact in mind it was planned to move the agricultural center of gravity eastward during the decade prior to the invasion. There were good reasons for the shift eastward aside from the danger of losing the western "breadbasket." The heavy concentration of industry in the West also was vulnerable to attack; so eastern industrial centers were built to utilize the rich natural resources of Siberia and the Urals and to establish a new munitions base beyond the invader's reach.

The rise of new industrial centers aided, as well as necessitated, the growth of agriculture in the East. Long food hauls from the western areas had to be eliminated. Even before the war Russian agriculture was bursting at

the seams with expansion. So it was that the vast untilled lands of the East beckoned despite their physical disadvantages, and Russian farmers became pioneers as daring as those of America's West a century earlier.

The government fostered the eastward movement by extending easy credits, irrigating arid regions, and popularizing the new land. As a result, about 18 million acres east of the Urals were brought under grain cultivation between 1933 and 1940. Grain now grows from the Arctic to the borders of India, and regions like Central Asia, which used to grow only enough grain for 3 months out of 12, were meeting all their needs by the time of the Axis attack.

Planting more than 5 million new acres in 1942 and plans for planting another 16 million this year to make up for loss of land in the West would have been far more difficult — perhaps impossible—if those 18 million acres in the East had not been developed before invasion of the West.

The case of Kazakhstan, a Soviet republic in Central Asia, is revealing. Ten years before the invasion, Kazakhstan was a barren land of nomad cattle breeders. The tent-dwellers lived on a level hardly different from that of the western American Indians of a century ago.

But between 1933 and 1940 the area under cultivation more than trebled. Most of the increase was in the comparatively fertile northern regions, but also included a desert region where 33,000 acres were reclaimed in 1941 and 67,000 in 1942. At the same time a survey was being made to facilitate opening of less arid land made accessible by 4,000 miles of new railroads.

Thruout the winter of 1941-42, while the Nazis were pounding at the gates of Moscow, farmers from the war-torn West poured into Kazakhstan. In 1942, some 1,022,500 acres of virgin land were planted, and plans drawn for sowing another 1,377,500 acres. Sugar beets, the one big deficit crop of the area, were sown widely.

The cattle herd, augmented from the West, increased 22 per cent despite a 70 per cent increase in slaughtering. It is estimated that the newly cleared area and the increase in cattle during 1942 and 1943 will provide enough food for more than 2,500,000 persons, barring extremely adverse weather conditions this year.

But how about farming in or near the German-occupied areas? Well, here the problems are indeed great. In no instances have the returning Red armies found more than a third of the original population alive after a period of Axis rule. It is estimated that

from 5 to 15 million civilians have died of starvation and disease, another 3 million have been taken to Germany as slaves, and hundreds of thousands have been slain in reprisal for guerrilla activity.

During the period of their occupation, Germans removed every bit of food and seed they could find. Special army units were created to confiscate those supplies of the Russian farmers that escaped destruction in the "earth scorching."

But as soon as a bit of ground is won back, Russian collective farmers resume working the soil and planting crops—sometimes under the very guns of their army. Two big factors keeping agriculture going are machinery and the labor of women.

All existing machinery is kept going day and night. A 10 per cent increase in work accomplished by these machines is equal to having to build tens of thousands of new ones not obtainable, the farmers are told. The Machine and Tractor Stations have erected a subsidiary network of small regional shops to make repairs and replacements. Tractor drivers have been given special mechanical training and are urged to make repairs and replacements themselves; bonuses are awarded those who do so.

Industrial enterprises have been asked to organize groups of skilled turners, smiths and welders to work in the fields on their days off, making machinery repairs on the spot.

Before the war about 20 million women worked on the farms. Of that number more than 14,000 had been elected chairmen or vice-chairmen of collective farms. More than 9,000 were graduates of agricultural colleges.

When war came an extensive training program was launched to increase the skill of women farmers. Almost one million attended wartime agricultural courses of various kinds. More than 700,000 newly-trained tractor drivers and combine operators are women.

Other thousands have been trained outside the classroom. Bonuses are awarded all farmers who train new farm workers. Drafted farmers are given brief deferments in which to train their wives, sisters or sweethearts.

A bonus system also is employed to encourage new farmers. The farmer who accomplishes twice as much as her neighbor receives 3 times as much pay, plus public recognition and honor. The Russian press each day reports the achievements of farmers. All Russia, for instance, knows Pasha Angelina, whose brigade of 10 or 12 tractor girls

plowed 2,937 acres, 230 per cent of their work plan, in 2 weeks, while saving 3 tons of fuel.

Young boys and girls have been urged to put aside their plans to become doctors, engineers and editors, and turn to farming. Without the food which spells victory, they are told, there would be only one career open to them—slavery.

As a result, all upper grades in high schools have since 1941 received obligatory instruction in farming and in operation of farm machinery. Boys and girls of 14 to 16 work 6 to 8 hours a day, 7 weeks a year, on the farms. More than 5 million youngsters worked in the fields during the summer of 1942. Schools of Moscow and other large cities close a month earlier and resume a month later. Generally the children work under supervision of teachers or summer camp staffs and boys and girls always work in separate groups. The farms provide keep and pay them the same rates received by adults for the same amount of work produced in the fields.

The government authorized local authorities to draft from the cities for farm duty all able-bodied men between 14 and 55 and women between 15 and 50, except those already in essential occupations, pregnant women, and women nursing children. The volunteer response of city dwellers has been so good there has been little need to use force.

The collective and state farms meet traveling expenses, provide board and lodging, and pay both in cash and in produce. City folks work in teams of 15 to 20 persons, under direction of experienced farmers. These teams frequently challenge one another to competition and results are watched with as much interest as baseball scores are watched in America.

The story of Russia's agricultural production today is one of territory lost, earth scorched, evacuees moved thousands of miles, machinery and manpower strained to the limit, and of scientists exerting all their skill and energies to the task of more production.

Feeding Materials By Way of the Soil

Condensed from Better Crops With Plant Food

Firman E. Bear

New Jersey Agricultural Experiment Station, New Brunswick, N. J.

ONE of the highly important tasks assigned to plants in the economy of Nature is that of collecting mineral elements from the soil and preparing them for the use of animals. Since plants have always constituted the primary food of animals, it has generally been assumed that, by and large, they supply everything, minerals included, which animals require.

In their natural state, animals are free to roam over large areas of land, and any deficiency of mineral elements that conceivably might exist in the plants growing in any one location should be compensated for by the more highly mineralized vegetation in another. Domesticated animals are known to have considerable capacity to balance their own rations when the opportunity is provided. It frequently happens, however, that when they are confined to a given ranch or farm, and their food consists only of the products of that area, specific abnormalities in growth and reproduction result.

It would appear, therefore, that certain soils and plants, or soil-plant associations, either do not supply all the mineral elements animals require or they do not provide them in suitable ratios or in adequate amounts. On the other hand, ill health of animals frequently arises not from any inadequacy of the several necessary mineral elements but from the presence in the soil or water of elements that are toxic, the most frequently mentioned mineral toxins being selenium and fluorine.

It is apparent from these considerations that there is need for diversity in the diet of animals. For man, the several food materials normally come from such widely separated areas and the soils in these areas differ so markedly in their mineral composition that little difficulty need be experienced in balancing the mineral supplies in the diet, if a reasonable degree of intelligent selection of foods is exercised. It is an interesting fact, however, that those groups of country folks whose diets are largely restricted to food products of local origin

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may suffer more from mineral deficiencies than do city folks of similar standards whose food supplies have their origin in such widely separated areas as Maine, Florida, Kansas, and California.

As would be expected, there is great variation in the mineral content of the many soil types of the United States of America. The differences in soils are due, in part, to the marked modifications in mineral makeup of the rocks from which the soils were formed. But, in most cases, climate is the dominating factor in determining the composition of the soil. Thus, the irrigated alkaline soils of the West, on drying, frequently show incrustations of the sulfates, chlorides, and carbonates of sodium, potassium, calcium, and magnesium. In contrast, the acid soils of the humid areas of the eastern and southern parts of the United States consist almost entirely of insoluble rock residues from which the water-soluble salts have long since been leached out and lost to the sea. In practice, the primary task of the man who farms in an arid area is to supply water to his soil, whereas that of the farmer in a humid area is to recover the lost soil salts from the beds of ancient seas, now occupying positions above the ocean level, and to haul them back to the land.

Fortunately for the United States, the wide expanse of highly productive soil constituting the great central grain and livestock belt receives enough rainfall for crop needs, yet not such an excess as would result in serious losses of mineral elements by leaching. Although there are normally no salt deposits on the surface of the soil of the prairies and plains, large supplies of some of the more important of these essential salts are stored lower in the soil profile, often within the ready reach of deep-rooted crop plants. The problem of maintaining the supply of mineral elements in the soils of these semi-humid areas is much less difficult of solution than it is in the heavier rainfall areas to the East and South.

Mineral deficiencies in plants, and in the diet of the animals that feed on these plants, are most likely to occur in marginal areas of the humid regions where the lay of the land, the physical properties of the soil, or the system of farming does not permit of the economic use of adequate amounts of lime and fertilizer, once the virgin fertility of the soil has become exhausted. Such farming areas are widely distributed throughout the older agricultural sections of the United States. The original soil organic matter in these areas contained considerable stores of mineral elements which had been collected over the centuries by the forest trees that

had grown up and fallen back on the land. But when the land was cleared and put under the plow, its reserves of mineral nutrients were soon exhausted by the leaching and eroding action of the unimpeded rainwater, and through crop removal.

Here and there over the United States and its possessions, one finds soils that are highly exceptional in their chemical composition. Depending upon the nature of their peculiarities, these soils have become noted for the poor or excellent nutritional quality of their produce, as the case may be. There are large areas of sand containing as much as 98% silica, the percentages of the essential nutrients being limited to very small figures. Some of the cultivated peats are made up mostly of severely leached organic matter which is very low in its content of mineral elements, particularly potassium. The lateritic soils of our tropical outposts often consist, in large part, of the oxides of iron and aluminum, the effect of which is to reduce the content of available phosphorus to a very low level. Certain Hawaiian soils contain as much as 70% manganese, and the plants growing on them become chlorotic unless sprayed with a solution of ferrous sulfate. Soils of the more humid areas of the United States are generally acid, often throughout the entire depth of their profiles, and contain relatively small amounts of available calcium and magnesium.

In contrast with these negative-propertied soils, there are many others that are famed for their very high content of the more important mineral elements. Thus soils of the irrigated arid areas are normally alkaline in reaction and very high in their content of basic cations. The soils of the great central plain and prairie areas, although slightly acid on the surface, are underlain with deposits of lime and gypsum at levels that are often within the reach of plant roots. The area around Lexington, Kentucky, widely known for its bluegrass and fine horses, is covered with soil the analysis of which shows as much as 1% phosphorus, in contrast to the all-too-common soils containing around 0.05% of this element. The lower depths of many of the limestone-valley soils in humid areas contain considerable amounts of carbonate of lime, which accounts, in large part, for the continued high productivity and the great popularity of these soils among farmers.

The operator of a farm situated on a soil containing high percentages of the essential mineral elements has, in effect, a gold mine the quality of whose output is reflected not only in high acre yields but in the fine finish of the livestock as well. Such soils

also put their stamp on the farmer's family, causing the children to grow up to more sturdy man- and womanhood than is the lot of those whose formative years are spent on land that is deficient in its supply of the highly essential mineral elements.

Yet, it is well to keep in mind that there is no necessary similarity in the composition of the soil and its plant produce. The mineral content of plants varies with the species, the variety or strain within that species, the climate of the area, the weather during the particular season of the plant's growth, and the stage of maturity of the crop at the time of harvest. Furthermore, if any one of the essential mineral elements is deficient in a soil, certain others that may be present in abundance tend to accumulate, often in relatively very high percentages, in the plants that grow on that soil. In some recent experiments involving the growing of alfalfa plants on prepared soils, the exchange complexes of which had been made to contain varying ratios of calcium to potassium, it was found possible to raise the calcium content of the dry matter in these plants from 0.77 to 1.82% and, meanwhile, to lower their potassium content from 3.30 to 1.15%, without materially affecting the yield. Similarly, although constant amounts of available magnesium and phosphorus were supplied in all cases, the magnesium content of the hay varied between 0.23 and 0.34% and that of phosphorus between 0.30 and 0.36%.

In proportion as the supply of any given element in the soil increases or decreases, however, the content of this element in the vegetation growing on that soil likewise tends to increase or decrease. This helps to explain the plant successions that occur in nature, the accumulation of minerals in the residues of one plant association making it possible for the succeeding higher association to gain a foothold. In agriculture, this process normally works in the opposite direction. Thus, if hay and pasture crops are removed for a period of years without compensation to the soil for its loss of mineral elements, the clovers gradually give way to the less nutritious but still highly useful timothy and bent-grass types, and these in turn to the almost worthless Andropogon (broomsedge) and Danthonia (poverty grass) types.

It is common practice among farmers to sow mixtures of legumes and grasses. They know that in proportion as the supplies of lime and mineral elements are present in adequate amounts in the soil, either over the whole field or in localized areas, the legumes will thrive, but if there are areas of deficiency, the grasses

rather than weeds will predominate. One of these standard sowing mixtures consists of alfalfa, red clover, alsike clover, and timothy seed. If such a seed mixture is sown, certain areas of the field may have an almost perfect stand of alfalfa whereas other areas will be covered equally well with one or another of the remaining three plants. As the field is reseeded to such mixtures over the years in the crop-rotation program, it frequently happens that although seed of all four plants may have been sown, only those of the timothy survive. An examination of the mineral composition of these four plants (table 1) provides an explanation of the farmer's experience.

The percentages recorded in table 1 represent averages of many determinations. The individual plants from the analysis of which these averages were derived may have varied greatly in their mineral composition, for as long as land is in a high state of fertility a plant growing on it enjoys luxury consumption of the elements that are present in greatest abundance, removing more of them from the soil than it requires. As the fertility level is reduced, however, the percentage content of the essential mineral elements in the plant falls to lower and lower levels until, in due time, it approaches a point below which any further decrease in the supply results in limiting the yield to the quantity of that element that is present in least abundance. At that stage, species of lower mineral requirements gain the ascendancy. Since relatively larger amounts of the elements that are present in greatest abundance are removed from the soil, the supplies of all the mineral elements tend gradually to fall to a minimum in both soil and plant. Thus, one can more nearly determine the actual mineral requirements of a plant by growing it on a depleted soil than on a highly fertile one. In other words, when the fertility level is high, the analysis of the plant is really an analysis of the soil on which it grew, and only when the supply of all the mineral elements is relatively low does it become an actual index of the needs of the plant.

If a higher level of mineral nutrition of animals is desired, this

Table 1—Percentage Mineral Elements and Nitrogen in Four Hay Plants

Plant	Calcium	Potassium	Phosphorus	Nitrogen
Alfalfa	1.43	2.02	0.21	2.02
Red Clover	1.21	1.58	0.18	1.58
Alsike Clover	0.76	1.44	0.23	1.44
Timothy	0.27	1.36	0.16	1.36

can be accomplished either by the use of feeds from areas where the soil is known to have a high content of the essential elements, or by a liberal use of lime and fertilizer on the soil on which the feed for these animals is to be grown. This does not argue, however, that the easiest or best means of supplying the supplemental amounts of the mineral elements that may be required by livestock in humid areas is by way of the soil. It is evident that the simplest procedure is to add salts of these elements to the feed in the animal's manger or trough.

Recently the biological method of evaluating soil fertility has again come into prominence. This method consists in feeding several lots of animals the produce from plots of very poor land that have been variously treated with lime and phosphate, and measuring the live-weight increase in relation to the amount of feed consumed. As would be expected, not only the yield but the feeding value per unit weight of produce is increased by the use of lime and phosphate on these very poor soils. This means that the farmer has the practical possibility of obtaining a two-fold profit from the use of these minerals on such soils.

But such possibilities are largely confined to sub-marginal land or to conditions of extensive farming such as occur on range land or stony pastures. They tend to disappear with increasing intensity of agriculture, since most soils must be limed and phosphated for economic yields. However, there still remains the possibility that animals would profit by a more abundant supply of minerals than the moderately limed and fertilized crops will contain. The question then arises, shall these be supplied by way of the soil, by the use of high-mineral protein supplements, or by direct addition of inorganic salts to the feed.

It is seldom that as much as 50% of any mineral element which is applied to a soil can be recovered in the harvested crop. Consequently, to feed minerals to the animal by way of the soil is not an economic procedure, unless the advantages from so doing more than offset this disadvantage. The smallness of the percentage recovery is due in part to losses by leaching and in part to the competitive power of the soil for certain of the elements, of which phosphorus is the best example.

The consumption of liming materials and fertilizers in the United States already totals nearly 25 million tons annually. Most of this tonnage is sold in the eastern and southern states; the concentration of its use in these areas being the result of the greater agricultural age of the soils, the

higher rainfall to which they have been subjected, the greater density of the population and resulting intensity in production, and the convenience to the natural supplies of nitrate and phosphate.

But when the virgin fertility of the soils of the prairie and plain states has also been exhausted, fertilizer tonnages will have to be greatly increased. For example, the great State of Iowa used some 17,000 tons of fertilizer on its 34 million acres of farm land in 1941, whereas New Jersey, with a farm area one-eighteenth that of Iowa, consumed 184,000 tons of fertilizer that year. This means that the rate of consumption of fertilizer in New Jersey is over 200 times that of Iowa.

It is one thing to use fertilizers up to their economic limits in terms of crop yields, and quite another to use them in such amounts as may be required to raise the mineral content of plants to equal that of the same species when growing on soils naturally containing large stores of available mineral elements. It appears probable that the needs of animals and the desires of the nutritionist would best be served by the combined use of three procedures: (a) using such amounts of lime and fertilizer as are required to guarantee the successful growth of economic yields of the high-mineral legume hay and forage crops on the better soil types, where the farming intensity is such as to justify it; (b) using somewhat smaller amounts of lime and fertilizer where the more extensive systems of livestock production are practiced, but harvesting the hay at the early-bloom stage, while its palatability and its percentage content of the mineral elements are relatively high; and (c) making regular use of mineral supplements in all cases where there is any doubt as to the adequacy of the supply of the necessary mineral elements.

In the present stage of our knowledge, yield of the marketable portion is the most important criterion in determining the point at which to stop increasing the rate of application of lime and fertilizer on any given soil and for any given crop. The primary business of the food- and feed-growing farmer is to produce carbohydrates, fats, and proteins for which there is always a ready market, as such, or in the form of livestock. The choice from among the plants which will produce one or more of these three groups of foodstuffs depends upon the soil and climatic conditions as well as the price at which they can be marketed. Having chosen his crops, if high yields are obtained, relatively high quality for those crops is likely also to be the reward.

Since proteins are most readily obtained by growing legumes, it

is to be expected that every economic effort will be made by the livestock farmer to increase the acreages of these high-mineral crops. Associated with the protein of legumes is the high calcium, phosphorus, sulfur, magnesium, and trace-element content which is so much desired. But the cost of growing legumes is almost prohibitive on certain types of soil. And the same soil types can often be made to grow quite satisfactory yields of some of the better carbohydrate crops, particularly the grasses. Protein can readily be built into grasses by the use of nitrogen fertilizers, the selling-price of which will probably fall to record lows after the war is over. By harvesting the nitrogen-fertilized hay grasses in their early-bloom stage, high-protein hay of relatively high mineral content can be produced. By grazing them at still earlier stages of their growth, further percentage increases in N and in mineral content can be obtained.

It may be well to point out that the next generation of plant breeders is likely to be more concerned with the production of crops that can utilize soil resources more efficiently and show higher yields of carbohydrates, fats, and proteins per unit of fertility. This is quite in contrast to our present procedure of breeding plants to rob the soil more effectively. The high-yielding plants of the future may not contain as high percentages of the mineral elements as their hardier relatives of today. This would point to the need of giving even more consideration to the supplemental use of minerals in both feed and food.

Generally speaking, it is doubtful whether mineral deficiencies will ever be very widespread if crop yields are maintained at economic levels of production. It does not pay to produce low yields. With every step-up in the yield that results from soil treatments there is likely to be a marked increase in the plant's content of the mineral element or elements required to produce that increase. But there will always be large areas of marginal land and of subnormal soil from which we shall have to accept crops of subnormal mineral content. The remedy in these cases will undoubtedly be found in the supplemental feeding of mineral mixtures. Maybe all of these minerals should first be applied to the soil, but this seems highly doubtful.

Christmas Tree Land

Condensed from The Western Farm Life

A little Montana town of less than 1,000 inhabitants is the Christmas tree capitol of the world. This little town is Eureka, in the heart of the Rockies near the Canadian border, 50 miles from the Idaho-Montana line. Last year it shipped well over 1,000,000 trees, 214 carloads, to all parts of the country. Four million of the 10,000,000 Christmas trees used throughout the nation come from a half dozen counties in northwestern Montana, which might be called "Christmas Tree Land."

In 1927, the first few thousand Christmas trees were shipped from this area to outside markets. Since that time, there has been a steady upward trend in this new industry which has sprung up almost unnoticed even in Montana, except in the particular communities involved. It has almost doubled in the last two seasons and jumped twice as much in 1941 as in the previous year.

Practically all of the Christmas trees shipped from this region are Douglas fir, which is neither a true fir nor spruce, but is similar to the hemlock. Its conspicuous cones, light and papery in texture, which fall off the tree whole, are found on all branches to near the base of the crown. Three-pronged bracts protrude from between the cone scales. The comparatively short, green needles are flat and soft to the touch, and definitely narrowed before joining the twig. At the end of the twig there is usually one bud, sometimes more, cone-shaped, sharp-pointed, shiny and smooth, and brownish-red in color.

Montana has found that the ideal Christmas tree is aromatic, stocky, short-jointed and symmetrical, with heavy foliage. It is springy and well covered with needles which will retain their evergreen color and will not shed easily. The Douglas fir meets these requirements. There is some demand for trees as tall as 20 feet, but most of them, when finally prepared for shipment, run from 2 to 10 feet high.

The Yuletide harvest begins in October, usually about the 10th, when the mountains are patched with snow. By December 10, the last load is on its way. But long before this, Montana is placing orders for Christmas trees, making arrangements for cutting areas, soliciting cutters, hiring trucks for hauling and establishing bank credit.

Before the trees leave the for-

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est, they must be inspected by a representative of the Christmas tree company that is buying them. Those from the national forest must be certified with red forest service Christmas tree tags showing that the cutting did not impair the silvicultural value of the forest.

They are graded as to size and quality as a basis for fixing prices to be paid by the purchaser, after which they are baled, the number in a bale varying with the size of the trees. Finally they are loaded into trucks and hauled to the shipping yards, where they are shifted to freight cars for their journey to all parts of the United States.

The treeless areas of the Great Plains are good markets but the bulk goes to the Middle West, with Chicago, Cleveland, St. Louis and Minneapolis as the chief destinations. The most distant point east is Philadelphia; south to Dallas, and west to San Francisco.

It can be readily seen that this industry is of vital importance to many people. There is the rancher who harvests a few hundred trees from his woodland, the large timberland owner who sells his trees by the thousands, the state forest service, and the national forest service, which combine Christmas tree sales with thinning operations.

Besides wages for local labor at a season of the year when employment normally is scarce, expenditures include truck hire, stumpage, office rental and other items. It gives employment to railroaders and truckers who transport the trees to market and to vendors who dispose of them on arrival at their far-flung destinations.

With 4,000,000 trees coming out of one corner of Montana in a single season, one might wonder if even the vast resources of the "Treasure State" might some day be depleted. However, during the time that Christmas tree cutting has been on a commercial basis in this region, national and state foresters have worked together to develop techniques and practices which will actually increase production.

Not more than 10 to 20 trees to the acre are cut, and no tree that is more than 8 feet from another established tree. It must be at least 3 feet and not over 20 feet high, unless marked by a forest officer for thinning. Stumps are cut low and slash and debris are properly disposed of to remove any fire hazard.

Many private owners, and 83 per cent of these Christmas trees come from private lands, are adopting the same wise rules to insure a continued crop. Under this management, these areas will produce perpetually.

A by-product industry is

springing up which utilizes the branches and trimmings from the stumps for evergreen ropes, wreaths, sprays and garlands. Corsages, decorated cones and various other types of novelties are also produced.

For every one of the 10,000,000 Christmas trees set up in its place of honor for the Yuletide season, the chances are one out of ten it came from the little town of Eureka, nestling in the Rockies in the far reaches of Montana.

They Seldom Use Scoops

Condensed from Nebraska Farmer

Tom Leadley

THE 480-acre farm of F. D. Allington and Son near Blue Springs, Nebraska, is often referred to as one on which a scoop shovel is never needed or used. That is not literally true, of course, but probably no other general livestock farm in the state can show less use of the much maligned scoop. The reason is that the Allingtons are geniuses in making machines, and labor-saving equipment and practices take the place of man labor.

Not only do machines and equipment save labor for the Allingtons, but livestock handling practices, such as the increased use of pasture crops, reduce the man labor needs on the farm.

Many other farmers might well profit from the Allington example in meeting labor shortages on their own farms.

The mechanical genius on the Allington farm is Duane who operates the place jointly with his father. Here are some of the things he has rigged up to save labor, with the aid of a well-equipped machine shop, a knack for mechanics and a practical knowledge of machine operation:

An attachment for a small combine to permit delivery of straw to either side, thus running two windrows in one to facilitate the use of a pick-up-straw baler. Last season 30,000 bales of straw and hay were "processed" by this machine for the Allingtons and their neighbors. As much as 1,000 bales, 70 to 80 pounds each in weight, have been turned out in a day with the pick-up baler. From 26 acres of combined wheat straw 500 bales were obtained last summer. The Allingtons say the pick-up baler answers the question: How to have straw when every farmer uses a combine?

A truck with power hoist and grain body built by Duane. The power take-off mechanism was purchased but installed by Duane. The grain body holds 200

Reprinted by permission from the Nebraska Farmer, Jan. 23, 1943

bushels of shelled grain when equipped with sideboards. The truck is filled by gravity flow from overhead bins in the grain elevator, and is emptied into the feedlot bunks by the power hoist.

Home-made tractor operated loader or shovel for loading corn, manure, dirt, etc.

A portable corn elevator adapted for loading silage into truck from trench silo. A small engine drives the elevator. The Allington trench silo is never covered by straw or dirt. There is no more spoilage and work of removing the silage is reduced. From 50 acres of Atlas sorgo, 600 tons of silage were harvested. The portable elevator, with extension, is also used for elevating baled hay. It will deliver to height of 24 feet.

Power post hole digger. Here's a lulu of a labor saver for that tired feeling which follows a few hours' work with a spade in hard ground. The augur is a conveyor from a grain elevator, attached to a Ford differential, and mounted on the front and side of a tractor and driven by chains from the power take-off pulley. Fifty holes three feet deep in one hour is its capacity. End to end that would be about 150 feet of hole, or a good start on an oil well. The auger is raised and lowered with a tractor steering rod.

A 10,000 bushel grain elevator, with inside dump and grain conveyor. This saves more labor than any equipment on the farm, says Duane. The elevator will handle ear, shelled or ground grain. In one year as much as 35,000 bushels of grain have been handled through this elevator untouched by hand. A grinder is located conveniently in the elevator and ground feed or other grain may be elevated into any bin. Outside spouts from overhead bins fill trucks or wagons in a hurry. When cattle are summer fed on grass, 400-bushel grain self-feeders are moved to the pasture and filled from the truck with a portable elevator. These are very important labor savers as one filling lasts two weeks. Another labor saver in cattle feeding is the use of a handy wagon with 8 by 14 foot bed, of light weight and easy to handle for hauling silage from the trench silo to feed bunks.

On every farm where power machinery is used successfully one does not need to look long to find a good machine shop. The Allington farm has one, not large, but well equipped with forge, welding equipment, power drill and saw, hack saw, and many tools for machine work. Most of the shop set-up has been worked out, and much of it made, by Duane.

Now let's look at the livestock and crop program on the Allington farm so we may appreciate more how important it is to re-

duce labor and labor costs. The farm is almost completely given over to livestock and the raising of feeds for it. Last year crops and pastures were about as follows: 100 acres of corn; 70 acres of wheat; 50 acres of Atlas sorgo for silage; 30 acres of oats; 30 acres of alfalfa; 80 acres of brome grass; 80 acres of native pasture and wild hay; 40 acres of mow land.

On the average, about 200 steers are fed out each year. In November, 72 Nebraska sand hill steers, bought as calves thirteen months earlier, were marketed. They were winter fed until spring on silage, protein concentrate and hay, and then self-fed ground corn on brome grass pasture until 30 days before marketing when they were placed in dry lot and fed corn, alfalfa and prairie hay. In the 13 months the steers gained about 600 pounds each. Self-feeding of cattle on pasture saves both feed and labor, Mr. Allington says.

Last year, 550 spring and fall pigs were raised from 85 sows, about 6.5 pigs per litter. Hog production was increased to the limit in 1942. Lack of equipment prevents raising more fall pigs. Pigs are farrowed in a central farrowing house and later moved to brome grass and alfalfa pasture and fed from self-feeders. They are housed in 12 by 16-foot portable houses. The work of watering which is very important, is eliminated by several ponds behind man-made dams. Feeding hogs on pasture saves 25 percent on grain, say the Allingtons.

Thirty acres of brome grass on which 250 hogs were pastured, also yielded 7,000 pounds of seed worth 15 cents a pound.

The ponds are deserving of more than mere mention. They provide a dependable water supply for the hogs and cattle, and check damaging soil erosion.

Other soil and moisture conserving practices used by the Allingtons include: Basin listing and manuring in the fall of land to be planted to sorghum; terracing and planting of row crops on the contour.

The Allington farm story is not complete without poultry. The 700 White Leghorn hens are handled with the minimum of work. The modern 96- by 18-foot hen house for 500 hens has built-in feed bins. The nests have screen bottoms on a slope which facilitates cleaning and deposits the eggs at the front of the nest for easy gathering. The hens eat from self-feeders. The house is electric lighted with an automatic control for turning the lights on early to increase egg production. Under the roosts are screened dropping boards.

At one end of the house is a cool basement room for grading and storing the eggs.

Low-Quality Proteins for High-Quality Requirements

Condensed from Successful Farming

F. B. Morrison

Head of Animal Husbandry Department, Cornell University

(As told to T. F. Lounsbury)

THE quality of the protein fed to sheep and cattle is much more important to the man who has to buy or produce it than to the animals themselves. In times of peace and plenty, the practical application of that fact can save time and money for the producers of these classes of livestock. In times of war and scarcity, it can release some of the high-quality proteins to supply the more critical needs of hogs and poultry.

Protein has long been a familiar word, but in recent months it has become as popular a farm topic as the weather. Before describing the protein-quality experiments and the newer feeding recommendations which have resulted, it might be well to explain briefly what protein is, to the extent of our knowledge, and describe its effects within the animal body, so far as we have been able to discover.

Unlike such a feed ingredient as salt, the chemical structure of which is simple and unvarying, protein represents a whole group of compounds, each highly complex in structure and varying widely, one from the other, in composition. There are at least 22 substances, known as amino acids, that might be called the building blocks with which all proteins are made. Singly and in combinations they serve different nutritional functions, and just as a group of variously shaped objects can be arranged to form numerous patterns, so can these "building blocks" be variously combined to make up the numerous protein types.

All of that simply means that salt is always salt, or calcium always calcium, but that the feed value of a given protein depends upon the number and combination of the building blocks it contains, and upon the ability of a particular kind of animal to digest and use it.

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When certain ones of the amino acids are not supplied by the protein in a feed ration, they can be made from excesses of other amino acids by the animal's mysterious body chemistry. However, there are certain amino acids essential to growth and maintenance that cannot be synthesized or manufactured by the body. These are called the *essential amino acids,* and proteins which do not provide all of them in adequate amounts are said to be proteins of low quality for feeding.

By this definition, corn grain, for example, does not supply high-quality protein. This does not mean that corn grain is anything but an excellent feed, but it does mean that it is a *poor feed* when its deficiencies are not corrected by the proper balancing of the ration.

Until quite recently, the statement regarding high-quality protein requirements was considered a rule without exceptions. But those members of the animal kingdom known as ruminants, and chiefly represented among farm animals by sheep and cattle, have proved to be exceptions which might be said to prove the rule. This discovery, as suggested at the beginning of the article, is of considerable importance to producers of all classes of livestock.

The experiments which proved ruminants less "choosy" than other animals in the matter of protein quality were based on little more than surmise, at the start. As conducted at Cornell and elsewhere, these experiments soon changed surmise to strong suspicion, suspicion to certainty, and recommendations based on the results can now be confidently put into practice.

Five separate experiments which included a total of 86 complete lactations were conducted by Salisbury and Bratton of the Cornell animal husbandry department to provide convincing proof that the condition and production of dairy cattle do not depend upon the kind or quality of the protein in the grain ration.

The test group was fed a simple grain ration containing ground corn, ground oats, corn-gluten feed, and corn-gluten meal. A feed analyst would rate this a low-quality-protein mixture, and any experienced dairyman would certainly consider it lacking in essentials for top production. For comparison, a check group was fed a mixture of not only ground corn, ground oats, and corn-gluten feed, but also soybean oil meal, linseed meal, cottonseed meal, and corn distillers' dried grains. To analysts and dairymen alike, that one sounds more like a real dairy mixture. Cows in both groups were fed corn silage and mixed

hay low in legumes for roughage.

In the first year's experiment, the cows fed the better mixture held a slight lead over the others in milk production. But the second experiment showed about the same production advantage for the group fed the low-quality-protein mixture. Out of all the experiments, two favored one group, two favored the other, and in the fifth there was no detectable difference. Results more nearly identical could hardly have been expected if all had been fed the same.

There was no difference in the condition of the cows in the two groups to suggest maintenance deficiencies, and this observation is supported by other recent experiments. For instance, in Wisconsin timothy hay and corn silage, supplemented by a grain mixture of corn, oats, and corn-gluten meal, enabled six-months-old heifers to make as good growth as on the same mixture augmented by bran and linseed meal.

Behind these experiments with dairy cows lie about 10 years of metabolism tests, conducted by Miller and Turk at the Cornell animal husbandry department, using sheep as "pilot" ruminants. To check their results under practical feed-lot conditions, Professor J. P. Willman, of the same department, conducted a series of feed trials with fattening lambs.

When linseed meal, soybean oil meal, whole soybeans, and corn-gluten meal were fed separately to test groups of lambs as protein supplements, the average daily gains varied only one-hundredth of a pound among the four variously fed groups. There was no significant difference in the net returns or the hundredweight valuation of the finished lambs. Linseed meal showed an indirect advantage, since the lambs receiving it were easier to keep on feed, and consumed more roughage.

Linseed meal also was proved somewhat superior to either distillers' or brewers' dried grains. Urea gave better results as a supplement where it replaced only a part of the linseed-meal allowance. When used as the only supplement, the lambs were inclined to go off feed and were not so fat at the end of the trials as they should have been. In all of the lamb-fattening trials mentioned so far, the several protein concentrates were used to supplement a ration of shelled corn, corn silage, ground limestone, and salt. Enough of the concentrates were supplied each lamb to give same amount of protein.

Contrary to earlier conclusions, alfalfa and red-clover hay were found to furnish excellent protein for lambs when fed in balanced rations. Timothy hay also was compared with these two, when used as a protein supplement.

For any practical consideration, there was no difference in the quality of the protein supplied, whether fed separately or as hay mixtures.

In general, it can be stated that proteins which would be of poor quality for non-ruminants have proved very definitely to be just as good for lambs as high-quality proteins. Corn-gluten meal or corn by-products can safely replace dried milk or soybean oil meal in the lambs' rations, for example. The latter two are much more critically needed for the non-ruminants.

Since dairy and beef cattle differ in their feed requirements, Professor R. B. Hinman, also of this department, conducted feed trials with yearling steers. These animals also proved their ability to utilize low-quality proteins, and the trials provided important facts on the comparative cost-versus-results values of linseed meal, soybean oil meal, and ground soybeans when used to supplement a ration of corn silage, mixed hay, and a mineral mixture.

To compensate for possible breed differences, grade Shorthorns, good-to-choice Aberdeen-Angus, and good-to-choice Herefords were used for the series of tests. Care was taken to balance the different test groups, and the experimental procedure was designed to place the responsibility for the results upon the particular protein concentrate under trial.

The average daily gains varied but a few ounces between the different groups, but under detailed analysis both linseed meal and ground soybeans showed a significant advantage over corn-gluten meal. Experiments conducted elsewhere have shown, however, that corn-gluten meal gives decidedly better results when used with a concentrate such as linseed meal than when fed as the only supplement.

At the time of these experiments, linseed meal sold for about $38 per ton. Using that figure as a basis, the relative *values* of the other ingredients per ton would be about $16 for the corn-gluten meal, $25 for the soybean oil meal, and $44 for the ground soybeans. These figures were arrived at by computing the several factors affecting feed costs and carcass values. And while such factors are highly variable, from place to place and from time to time, the relative position of these feeds in scale of values may reasonably be expected to hold true when they are used as the only protein supplement for this type of livestock feeding.

What do sheep and cattle have that poultry and hogs do not have? A kind of "four-fold stomach." How can they convert low-quality proteins to meet their

high-quality requirements? They cannot; at least, not unassisted. Within the huge first stomach, or rumen (which accounts for the name ruminant), millions of bacteria thrive and multiply. These tiny organisms are able to alter the protein building blocks furnished by the feed the animal has eaten, so that the nutritional requirements of their own cell structures will be supplied. To some extent, they can even make proteins from simple nitrogenous substances like urea. Farther along in the digestive tract these bacteria are digested, and the cow or sheep gets a good protein meal.

It is important to remember that the rumen is not sufficiently developed at birth to perform the functions just described. The feed requirements of very young ruminants are therefore very similar to those of non-ruminants. This fact is especially important when calf starters or calf meals replace milk in raising young dairy calves. Such calf feeds must contain protein of good quality. But if mature ruminants receive adequate balanced amounts of vegetable proteins, higher-quality animal and marine proteins can be reserved for pork, poultry, and egg production.

Nor do vitamins enter seriously into the sheep and cattle feeding problems. Twenty-eight pounds of poor hay are needed to meet the carotene and Vitamin A requirements of a dairy cow, but 7½ pounds of legume hay, or 12 pounds of good corn silage, will give the needed minimum. Good pasture and winter roughage will supply the ordinary Vitamin D requirements of mature animals. Vitamin C is apparently destroyed by digestive processes, but adequate amounts can be "manufactured" by methods previously described. There is nothing to show that Vitamin E supplements need be added to good dairy rations, and all ruminants have proved their internal manufacturing ability so far as the B-complex vitamins are concerned.

The American farmer must now be asked to lend his unselfish support to the voluntary rationing of feedstuffs. Such support may even prove wise where it means using less economical or less readily available feed ingredients. For if voluntary rationing cannot be made to work, it will follow that some national plan of enforced rationing will be put into effect.

Breeding Poultry To Live Through Disease Resistance

Condensed from Farm Research

F. B. Hutt

Ithaca, N. Y.

WITHIN the past 15 years, mortality rates in large commercial flocks of poultry have increased to such an extent that poultry raising has become a much more risky business than it was in the old days when adult birds were not likely to experience more than 10 per cent mortality during their first laying year. This problem is particularly acute in large flocks because these always suffer most from disease.

The rise in the death rate has resulted from various forms of the "avian leukosis complex," which includes what the poultryman calls fowl paralysis, and big liver, or what the pathologist calls neurolymphomatosis, leukosis, lymphocytosis, and other terms. These conditions are characterized by the accumulation of lymphocytes which cause tumors. In some cases the tumors are in the liver, or spleen, while in other cases, the ovary is the site of the abnormal growth. Sometimes it occurs in the nerves of the wings, or of the legs, and causes paralysis. So far as is now known, all of these conditions are caused by a virus to which the chicks are comparatively susceptible during the first few weeks of life but relatively resistant after they mature. The importance of this group of diseases is shown by the fact that in the New York egg-laying tests at Horseheads and at Stafford, 45 per cent of all deaths during the year that ended in September, 1942, were caused by some form of avian leukosis.

Poultrymen were formerly advised to secure stock from flocks in which this disease had never occurred. It soon became evident, however, that such stock was usually extremely susceptible to leukosis. A more practical solution of the problem came with the discovery that chicks reared in complete isolation had less of this disease. However, complete isolation is not easy to attain, because it means separate attendants, separate trucks, separate supplies

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of feed, and no contact whatever between the young growing stock and older birds.

At Cornell University, experiments were begun in 1935 to determine whether it would be feasible to breed White Leghorns with greater resistance to this disease than is found in the ordinary flock. The experiment was based on the knowledge that, even when the disease is at its worst, there are always some survivors. There was also evidence that some families tended to be more resistant than others. After only two or three generations of selection it was clear that, by ultilizing resistant families, lines of poultry could be differentiated that were comparatively resistant to paralysis and the related diseases.

In this experiment, all chicks are pedigreed so that the sire and dam of each chick is known. An attempt is made to raise all chicks in the experiment under uniform environmental conditions from the time that the egg goes into the incubator to the time when the test is completed when the chicken is 500 days of age. This means that representatives of the different families under test are mixed entirely at random in the incubators, in the brooders, on the rearing range, and in the laying houses. One difference from good commercial practice is that there is no culling of weaklings. Every chicken in the test is given a chance to show whether it will live or die. Families in which many birds die are eliminated as undesirable, while those in which mortality is lowest, particularly that from leukosis, are the ones most prized for the breeding pen.

Poultrymen are accustomed to evaluating the males that they use according to the pedigree, which gives the performance of the ancestors. In this experiment, the performance of the ancestors matters much less than does the performance of the progeny. Males whose progeny survive and lay well, are used a second year and even a third year in the breeding pen, but even the son of a 300-egg hen is discarded if his daughters cannot survive any better than the average for the flock.

Some idea of the extent to which sires differ in transmitting viability to the offspring is shown by the study of two males. They do not differ much in appearance, and from their pedigrees it was considered that they had equal chances to produce viable offspring. However, from the time when their daughters were housed in the fall of 1942 at 160 days of age, up to the end of April, 1943, J2818 had lost more than five times as many daughters as had J2816. It is not unusual to find that, whereas the best sire of some 15 tested in one year may have in his daughters mortality as low as

32 per cent to 500 days of age, the worst sire in the same year may lose 70 per cent of his offspring in the same period.

Similar differences between dams are also evident. For example, in one family that proved unusually susceptible, 57 per cent of the sire's daughters died during the test period, and 26 per cent of them had leukosis of some form or another. One female mated to this sire lost all of her 15 daughters, ten of them with leukosis, and other dams had losses almost as bad. However, one good female in this pen had 17 daughters under test, not one of which died of leukosis. In her whole family, only a single daughter died and that one from nothing more serious than bumblefoot.

The unselected and unculled population hatched in 1935 experienced mortality of 64 per cent during the test period. In the fourth selected generation, mortality had dropped to 38 per cent and deaths from the leukosis complex were down to 12 per cent of the birds housed. In the next two or three years, it became apparent that further progress depended upon testing a larger number of males. When one is seeking sires that can transmit viability and, at the same time, produce daughters of large size, able to lay well, and to lay 2-ounce eggs, the chance of any one sire being satisfactory in all of these objectives is small. It is unusual to find more than 20 per cent of the cockerels tested that are satisfactory in all respects and worth using another year. This is an important point for farmers to remember who are starting on a progeny-testing program. To be effective, at least five or six cockerels should be tested each year, and it would be better if ten could be tried.

The question arises whether the decline in mortality in the lines bred for resistance to disease at Cornell really results from a hereditary capacity to withstand disease or whether there has been a decrease in the severity of exposure. This is answered in part by the fact that, while two different lines of resistant Leghorns were being established, another line was bred for increased susceptibility to disease. To get this latter stock the process of selection was reversed in that the breeders selected came from the families in which losses had been heaviest. In the fourth selected generation, deaths from leukosis accounted for 26 per cent of the birds in the susceptible line but only 12 per cent of the birds in the "C" resistant line. Among the chicks hatched in 1941 were three males in the "K" line, none of which lost more than 5 per cent of his daughters from the diseases included in the leukosis complex. All of these had less

than 30 per cent mortality in their daughters from all causes, from housing time up to 500 days of age, in spite of the fact that there was no culling among them at any time.

A practical question arising along with such work, is whether it is feasible to breed strains resistant to disease and to have them economically profitable with respect to egg production, size of egg, size of bird, and other things of market value. To this question, the answer is definitely in the affirmative. Since the experiment was begun, body size has been increased in the resistant lines and egg size has been raised to a point where very little selection is necessary each year to maintain it at the level of about 2 ounces per egg which the market desires. At the same time, egg production per bird has been increased. Since a higher proportion of the flock is surviving than formerly, and since these survivors lay more eggs per bird, the whole enterprise is much more profitable than before selection for viability was begun. Furthermore, there is every reason to expect that, since many more cockerels are now being tested, continued improvement in viability, and perhaps also in egg production, will follow.

Finally, it should be said that there is no reason why selection of this type cannot be practised by any good poultryman who can do progeny-testing provided that he is able to manage the records that are involved. It is desirable, however, that anyone trying such work should plan on testing at least ten cockerels each year. This can be done satisfactorily, even where only five breeding pens are available, by using five males in the first half of the breeding season and five others in the second half.

Cows Prove That They Can Take It

Condensed from The Jersey Bulletin

DAIRY cows kept in a cold pen-type barn during the past two winters, produced nearly as much milk as did their herd mates kept in stalls in a typical dairy barn. That is what four research workers at the University of Wisconsin are reporting upon an investigation set up two years ago.

To test the idea that modern dairy cows might be unnecessarily pampered—that they might do about as well in cold low-cost barns made with single, insulated walls, earth floors, and no stanchions, with manure and bedding removed only once or twice a year.

Such a barn on the University of Wisconsin farm near Madison is being compared with a warm, stall-type barn. The performance of cows is being asked to tell the story. So far it is still an open question whether, everything considered, the pen barn is as satisfactory as a conventional barn.

The Wisconsin investigators are certain good production is possible in a cold barn. They report that cows kept in the pen barn averaged 41.9 lbs. milk per animal daily over a six-month period from October to April during each of the past two years. By way of contrast, stall barn cows averaged 2.8 lbs. more milk per day in the 1942-43 season, and 3.5 lbs. more the previous year.

So far, production has been about 7½% better in the stall barn, but it is not yet certain that the type of barn or its temperature is responsible for the difference. If the stall barn has had somewhat better animals than the pen barn, in spite of efforts to maintain equally good cows in both, that can account for the difference in production. So to settle the question it will be necessary to divide the herd again and continue the trials for several more years.

There has never been any abnormal drop in the production of pen-barn cows during extreme cold spells—a fact which argues against the idea that low temperatures may be responsible for the slightly lower production of these animals.

Although the pen barn has a generally low, widely-fluctuating temperature—only about 7 to 10° warmer than outdoors—nevertheless the warm, fermenting manure and bedding packed beneath the cows no doubt helps keep them comfortable, particularly

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when lying down. Thermocouples installed in the manure just beneath the straw showed the temperature there to range between 70 and 100° F., regardless of the weather.

The quality of the milk, like its quantity, proved satisfactory in both barns, but not as high in the pen barn as in the other. Bacteria counts taken at weekly intervals for two seasons averaged 11,000 in the pen barn and 6,000 in the stall barn. This means the milk from both barns was exceptionally good, well below the 50,000 count allowed for Grade A raw milk.

In order to keep the pen-barn cows clean it is necessary to use about twice as much bedding as in the stall barn. That should not be any great disadvantage on farms with a surplus of straw, but it would be seriously objectionable where bedding is scarce or has to be purchased.

As for the amount of hay and silage required, there was practically no difference between the two barns during the 1942-43 season. Pen-barn cows used somewhat more hay than the others the first winter but evidently that was because they wasted some when it was fed in an outdoor rack. All roughage has since been fed in an inside bunk which holds wastage to a minimum.

Pen-barn cows have consumed slightly less grain and other concentrates than have the stall-barn animals during the past two years, but this only reflects the fact that all cows are fed according to production.

On at least one point—freedom from hock and knee injuries—animals kept in the pen barn clearly have been ahead. There has been no trouble whatever with these ailments in the pen barn, whereas more than half the stall-barn cows have suffered from them to some degree. Evidently the large Holsteins used in this investigation—they average more than 1,450 pounds apiece—are especially susceptible to injuries of this sort when kept on hard floors, but escape when manure and bedding are allowed to pile up underneath them.

Sore feet, which develop more often than knee and hock injuries in most herds, have not shown up in many cases in this investigation, but they have been more common in the stall barn than in the other.

In other respects there has been no important difference in the health of animals kept in the two barns, although the pen-barn cows have had better appetites and gained more weight—the latter at least in part compensating for their slightly lower milk production.

Calves have done well enough in the cold pen barn, although they have not gained weight quite

as fast as those kept in warmer quarters. Indications are that it may be advantageous to keep calves under relatively warm conditions the first three weeks, but that later they do just about as well in a cold barn.

The pen barn has an advantage from the standpoint of efficient herd management, in that it is easier to detect heat periods when cows run loose than when they are stanchioned. There is reason to believe that heat often is unnoticed when the animals are kept in a conventional barn.

Thus far the investigation has not revealed any important difference in the amount of labor required to do chores under the two systems. It takes 15 minutes longer to milk the 15-cow pen-barn herd in a separate milking room, in comparison with milking the stall barn herd of the same size in its regular stanchions.

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COMMENTS

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—*Kentucky*

"A young friend of mine who has been teaching agriculture in our local high school has been called to the service of our country. Wishing to give him something he would enjoy, he asked that we send him the Farmers Digest."—*Illinois*

"I want you to know that I am receiving a liberal agricultural education from your Farmers Digest."—*Pennsylvania*

"Your magazine meets the long-felt need of farmers and busy agricultural workers like myself."—*Arkansas*

"Please also accept my hearty appreciation and thanks for the high quality of your magazine. It is mighty interesting and stimulating."—*Massachusetts*

"We use the Farmers Digest very often in the Agricultural Department, and find it is an up to the minute text book in itself."—*Indiana*

"I consider the Farmers Digest the best all-round farm magazine published in the United States today."—*North Carolina*

"The boys have a waiting list to read the Farmers Digest."
—*Ohio*

"I have received every number of your valuable journal since the first issue in May, 1937, and have appreciated it very much. It is getting better with each issue."—*Tennessee*

"I enjoy your publication and wish every farmer in the state could read the Digest."—*North Carolina*

"I would like to offer sincere congratulations on your publication which will certainly be of interest to us in providing a valuable summary of current farming thought in America."
—*New Zealand*